BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JANUARY, 1942.

I.—SUB-ATOMICS.

Hyperfine structure in the arc spectrum of tin. S. Tolansky and G. O. Forester (*Phil. Mag.*, 1941, [vii], **32**, 315—323; cf. A., 1934, 823).—From measurements on the spectrum excited by a hot hollow-cathode discharge, data are reported for λλ 3352, 2832, 5632, 3223, *3034, 3009, *2863, and 2762, where * denotes reversal. The last six are classified, analysed, and discussed in detail, and interval factors are derived for 7 terms including the complete group belonging to the deep $5p^2$ electron configuration. The nuclear coupling of this group is large, in agreement with deductions on the coupling of the $5p^4$ group in I. A J-val. is allocated to one term. The two odd isotopes 117 and 119 have nuclear spins ½ and identical nuclear magnetic moments. No even isotope displacements were observed, and observations on reversals show that any such existing must be very small. N. M. B.

Polarisation of some spectral lines excited by low-speed electrons in a discharge tube containing mercury or mercury–cadmium amalgam as anode. B. N. Ghosh (*Current Sci.*, 1941, **10**, 325—326).—60-v. electrons were allowed to impinge on the surface of Hg or 2% Cd amalgam at 130°. The depolarisation of the 5791, 5770, and 5461 A. Hg lines was increased by the Cd, and rendered complete by a transverse magnetic field of 100 gauss applied to the discharge zone. A. J. E. W.

Transient discharges in mercury [vapour] at high pressures. R. Rompe and P. Schulz (*Physikal. Z.*, 1941, **42**, 105—110).—The production of periodic discharges of very high intrinsic brilliancy and short duration ($\sim 5 \times 10^{-6}$ sec.) is described. The discharge is established in a gap between two activated W electrodes in a heated bulb containing an inert gas and Hg vapour at 1—6 atm. pressure (p); the transient illuminating power (i), with an energy input of ~70 w.-scc. per discharge, is $\gtrsim \sim 1{\cdot}2 \times 10^7$ c.p. The effects of peak voltage ($\gtrsim$20 kv.) and p on i and the max. discharge current ($\gtrsim$60,500 amp.) are examined, and the spectrum of the discharge is shown. A. J. E. W.

Zeeman effect data and further classification of the first spark spectrum of cerium, Ce II. G. R. Harrison, W. E. Albertson, and N. F. Hosford (*J. Opt. Soc. Amer.*, 1941, **31**, 439—448).—Data are recorded for the Ce II spectrum over the range 2500—7000 A., photographed in magnetic fields up to 96,400 oersteds, g and J vals. are determined for 280 levels. The energy system of Ce II consists of a lower group of levels $4f^26s$, $4f^25d$, $4f^26p$ and $4f^3$, and a higher group $4f5d6s$, $4f5d^2$, $4f5d6p$, $4f6s6p$. Interactions of the levels are strong. The g sum rule is found to be exact when all perturbing terms are known. L. J. J.

Zeeman effects in the palladium spectrum. C. H. Lindsley and N. Rosen (*J. Opt. Soc. Amer.*, 1941, **31**, 531—533).—Data for 37 Pd I and 127 Pd II lines are recorded, measured in a field of ~87,500 gauss. g vals. for levels arising from $4d^95s$ and $4d^95p$ for Pd I and $4d^85s$ and $4d^85p$ for Pd II are given. L. J. J.

Useful X-ray data. E. W. Pike (*J. Appl. Physics*, 1941, **12**, 206—209).—The measured mass absorption coeffs. of Allen and Wrede for H, Be, C, N, O, F, Na, Al, Si, Cl, and Br have been fitted to $\mu/\rho = a\lambda^n + c/(1 + 0{\cdot}048/\lambda)$ by least squares and the vals. of a, n, and c tabulated. The energy distribution in the continuous X-ray spectrum from 20 to 70 kv., as measured by Kirkpatrick and by Ulrey, has been recomputed and presented graphically. D. F. R.

X-Ray physics and X-ray tubes. V. Hicks (*J. Appl. Physics*, 1941, **12**, 364—373).—A review dealing with the nature of the X-ray spectrum (continuous and line), absorption of X-rays, and the measurement of X-ray intensity. The design and manufacture of X-ray tubes for various purposes, and of valve tubes, are also described. A. J. M.

Spectral and total thermal emissivities of oxide-coated cathodes. G. E. Moore and H. W. Allison (*J. Appl. Physics*, 1941, **12**, 431—435).—The emissivities of oxide-coated cathodes of the uncombined type, such as are used in valves for telephone repeaters and radio receivers, have been determined. The spectral emissivity of the type of coating used on equipotential cathodes was determined at 0·65 μ., in the temp. range 900—1200° K., using the tubular-filament method, and the results were checked by the diffuse reflectometer method of Prescott *et al.* (A., 1939, I, 51, 159). The latter method was also used with filament cathodes, and the determination was extended to room temp. There is no variation of spectral emissivity with temp. A. J. M.

Photon counters for spectral investigations in the ultra-violet. M. N. Djatschenko (*J. Physics U.S.S.R.*, 1940, **3**, 479—486).—The construction of photon counters with polished Al cathodes is described. The spectral distribution of the ultra-violet fluorescence of rock-salt excited by X-rays has been investigated by means of a three-electrode counter, in which a grid between the cathode and anode allows analysis of the energy distribution of the emitted photoelectrons. O. D. S.

The electronic charge. V. D. Hopper and T. H. Laby (*Proc. Roy. Soc.*, 1941, **A, 178**, 243—272).—The determination was carried out by a new oil-drop method. The drop first falls under gravity between two vertical plane electrodes and is then deflected by the application of a horizontal electric field. The fall of the drop is recorded photographically by intermittent illumination. The main error arises from uncertainty of the val. of the viscosity of air; the result agrees within the limits of error with the val. found from X-ray data. G. D. P.

Evaluation of the Avogadro number, N, and the charge on the electron, e, by X-rays. J. A. Bearden (*J. Appl. Physics*, 1941, **12**, 395—403).—X-Ray methods can give more exact information about the physical consts. N, e, h, and m than any other available method. The determination of the λ of X-rays by diffraction methods is described. The grating const. of calcite crystals has been obtained by comparison of crystal and grating λ, and can also be obtained from chemical data. For calcite $d = (M/2N\rho\phi)$ where M = mol. wt., ρ = density, ϕ = vol. of a rhombohedron the perpendicular distance between the opposite faces of which is 1. N can be calc. from this, the val. on the physical scale of at. wts. being $(6{\cdot}0245 \pm 0{\cdot}0004)10^{23}$. The val. of e deduced from this is $(4{\cdot}8024 \pm 0{\cdot}0006)10^{-10}$ e.s.u., but its accuracy is limited by that of the Faraday. A. J. M.

Electrostatic cylindrical electron lenses. A. M. Straschkevitsch (*J. Physics U.S.S.R.*, 1940, **3**, 507—523).—Mathematical. The potential fields of electron optical systems with a narrow slit in a plane or cylindrical electrostatically charged diaphragm are investigated. Formulæ are derived for the focal lengths of cylindrical electron lenses based on similar arrangements. O. D. S.

Structure of gas discharges. H. Raether (*Naturwiss.*, 1940, **28**, 749—750).—Two types of gas discharge are recognised, the Townsend structure and the canal structure. In the Townsend type the increase of current with time is determined by ionic mobility. In the canal structure the first burst of electrons to leave the cathode produces such an intense field at its head that the discharge proceeds rapidly towards the

anode in a canal form. An even more rapid canal discharge is then developed towards the cathode. The conditions under which the canal type of discharge occurs are examined. The Townsend structure predominates for pd <1000 torr cm., and the canal structure for pd >1000 (p = pressure, d = distance between electrodes). The vals. of the static breakdown field strength for pd >1000 are compared with the calc. vals. The dependence of the time required for building up the discharge on the excess of the applied potential above the static potential for breakdown is investigated. A. J. M.

Cathode drop of an arc. G. H. Fett (*J. Appl. Physics*, 1941, **12**, 436—438).—The cathode drop of an arc has been measured for Cu, Fe, Ag, Pt, and steel electrodes, and arc welding electrodes, with and without coatings. The time for an arc to establish the cathode-drop voltage measured from the time the last contact causes an appreciable voltage drop is <40 μ-sec. For an arc between Cu electrodes in air, the voltage across the contacts at the instant of separation is independent of the current in the range 0·5—10 amp., independent of the open circuit voltage after the arc was extinguished in the range 8—230 v., and also of the circuit parameters and speed of separation of the contacts. It varies with the pressure of the atm. in which the arc is burning. For Cu the drop decreases from 13 v. at atm. pressure to 8 v. at 0·1 mm. The drop depends on the nature of the electrodes and, in the case of welding electrodes, on the coating, if any. A. J. M.

Production of large ionic currents. II. M. I. Korsunski and S. T. Shavlo (*J. Physics U.S.S.R.*, 1940, **3**, 385—392).—Conditions have been examined for the formation of ions due to ionisation by electrons in a gas at such pressures that the free path of the electron is > the distance between the electrodes. The dependence of the ionic current on potential at const. pressure, accelerating potential and grid potential, and the dependence on gas pressure, have been determined. The effect of pressure on ionic current is complicated; there exists a limiting pressure above which it is possible to get a very large ionic current. In the neighbourhood of this the discharge becomes very unstable. There is an oscillatory motion of electrons between the electrodes. With suitable parameters, the probability of ionisation is so great that the no. of ions generated per electron is >1. A. J. M.

Theory of anode fall in glow discharges. A von Engel (*Phil. Mag.*, 1941, [vii], **32**, 417—426).—A theory is developed which relates to the processes occurring in the neighbourhood of the anode when a positive column is present. The factors which determine the dependence of anode fall on discharge current are studied. The theory is verified by previous data for discharges in H_2, D_2, N_2, O_2, He, Ne, and A. A. J. E. W.

Theory of non-stationary states of the electric discharge plasma. B. Granovski (*J. Physics U.S.S.R.*, 1940, **3**, 195—218).—Mathematical. Schottky's diffusion theory is generalised to include non-stationary states of the plasma in low-pressure discharges of low and medium frequency. L. J. J.

Temperature of the ionosphere. R. Penndorf (Naturwiss., 1940, **28**, 751).—The temp. of the F_2 layer is 500—1000° K. according to the composition of the air. The temp. of the E layer where the N_2 is not dissociated and the O_2 is beginning to dissociate is 330—374° K. The temp. of other parts of these layers are calc. on the basis of the different composition of the air. A. J. M.

Recoil-electron spectrum of γ-rays from radium-C. G. D. Latischev, A. F. Kompaneetz, N. P. Borisov, and I. M. Gusak (*J. Physics U.S.S.R.*, 1940, **3**, 251—262).—A method of analysing energies of recoil electrons is developed; it consists essentially of a magnetic spectrograph with two Geiger–Müller counters for recording the electrons by the coincidence method. The method is applied to the examination of the recoil-electron spectrum of Ra-*C*. The energy spectrum shows a no. of peaks. Comparison with the internal conversion positron spectrum indicates that the relative intensities of the γ-lines of Ra-*C* obtained from the positron spectrum and the recoil-electron spectrum are the same. The theoretical curve calc. from Jaeger and Hulme's theory (A., 1935, 557) which gives the dependence of the internal conversion coeff. on the γ-ray energy for quadripole transitions is verified. The principal hard γ-lines of the Ra-*C* spectrum are of quadripole origin. A. J. M.

Positron spectrum of radium-C. A. I. Alichanov and G. D. Latischev (*J. Physics U.S.S.R.*, 1940, **3**, 263—274).—The positron spectrum of Ra-*C* has been investigated with improved apparatus. The curve of energy against no. of positrons shows 11 sharp drops, each corresponding with a γ-line of which the energy can be calc. All the positrons from Ra-*C* arise from internal conversion of γ-rays. It is shown that the total intensity of a large no. of γ-lines of Ra-*C* is comparable with the intensity of the strongest γ-line of Ra-*C*. The theory of Jaeger and Hulme (A., 1935, 557) is verified. No drop corresponding with energy of 1414 ke.v. of a nucleus level in Ra-*C'* has been observed, in agreement with the fact that a transition from this level with emission of a γ-ray is forbidden. A. J. M.

Radioactive thallium isotope thorium-C''. J. Zirkler (*Z. physikal. Chem.*, 1940, **A, 187**, 103—104).—Measurements of the coeff. of partition of Th-*C''* between Tl$^{\cdot}$ and Tl$^{\cdot\cdot\cdot}$ at 50° give the same result as at lower temp., whence it appears that the effect is not due to ion hydration. It was previously suggested (cf. A., 1936, 282, 791) that the distribution is determined by the mass-ratio of the Tl isotopes. The mean of 12 experiments gives for this ratio $^{203}Tl/^{205}Tl = 29·5/70·4$, in agreement with the mass-spectrograph result. F. L. U.

Scattering of photo-neutrons by nuclei. A. I. Leipunski (*J. Physics U.S.S.R.*, 1940, **3**, 231—236).—Dunning's result (A., 1934, 714) that the scattering cross-section of photo-neutrons increases smoothly from element to element with increasing at. wt. is due to the use of a detector sensitive only to high-energy neutrons. Experiments on the scattering of neutrons obtained by bombarding Be and D with γ-rays from Ra and Ra-Th with a more sensitive detector show that the cross-section varies irregularly from element to element. Neutrons of energies 130, 220, and 900 ke.v. were used. For light elements (H—Ca) sharp max. are found in the curve of scattering cross-section against neutron energy, pointing to the existence of resonance levels. These effects explain the irregular variation of cross-section. For heavy nuclei (Mn—Bi) the curve falls regularly as neutron energy increases, agreeing with the statistical theory of nuclei. The variation of cross-section for these elements is connected with some individual property of the nucleus. The variation of cross-section of thermal neutrons in the case of heavy elements depends largely on the existence of levels in the nucleus near the thermal energy. In those cases where resonance levels have not been observed, or where they lie far from the thermal region, it is possible that there are levels with energies slightly < the capture energy of a neutron by the nucleus. A. J. M.

Isomerism of atomic nuclei. L. I. Rusinov and A. A. Jusefovitsch (*J. Physics U.S.S.R.*, 1940, **3**, 281—286).—The β- and γ-transformations of the radioactive ^{80}Br nucleus are considered. Each β-transition is accompanied by the evolution of a soft electron, supposed to be an electron of internal conversion. This hypothesis requires the emission of X-rays in the process of decay of radioactive Br, and these were detected. This confirms the theory of Bohr and Weizsäcker that isomerism of nuclei is due to different (metastable) energy states of the nuclei. A suggested scheme of transitions of isomeric Br is given. To establish the theory completely it is necessary to show experimentally that the small probability of transition of the nucleus from the metastable to the ground state is due to the great difference of angular momenta corresponding with the levels. Experimental data are at present insufficient to prove this, but it is known that in the 48-ke.v. transition of the nucleus from the metastable level the change in the angular momentum is at least 2 units. A. J. M.

Radiations from bromine (^{82}Br). J. Rotblat (*Nature*, 1941, **148**, 371—372).—The radioactive Br was prepared by irradiating a thin layer of Se evaporated on Au foil with 4-Mc.v. protons from a cyclotron. The β-ray absorption curve indicates that the β-radiation from ^{82}Br consists of two groups with 97% of the disintegrations having an upper energy limit of 460±10 ke.v., and 3% having an upper limit of 1200±50 ke.v. Absorption of the γ-rays in Pb and Al gives a two-component curve, indicating the existence of two γ-quanta of ~700 and 1300 ke.v., the former being twice as intense as the latter. Absorption of Compton electrons

showed the existence of a γ-ray line of 1250 ± 50 ke.v., with a second component of 700 ± 50 ke.v. The intensity of the softer γ-quantum is twice that of the harder. The rate of β–γ coincidences is $4{\cdot}88\pm0{\cdot}07$ per 1000 β-rays, and that of γ–γ coincidences, $3{\cdot}14\pm0{\cdot}07$ per 1000 γ-rays. Hence the γ-rays following the emission of the main group of β-rays form a cascade of 3 quanta per disintegration. A nuclear level scheme of ^{82}Kr and ^{82}Br representing these results is given. The total disintegration energy of ^{82}Br is 3·1 Me.v. L. S. T.

Artificial radioactivity. V. K. Diebner and E. Grassmann (*Physikal. Z.*, 1940, **41**, 157—194; cf. A., 1939, I, 294).—A detailed review of work published in 1939. A. J. E. W.

Deuteron–tritium reaction in fluorine. R. S. Krishnan (*Nature*, 1941, **148**, 407—408; cf. A., 1941, I, 360).—Bombardment of NaF with 9-Me.v. deuterons, and a LaF_3 separation from the irradiated sample, give a fluoride fraction which shows, in addition to a short-period activity, an intense positron 112 ± 2-min. activity. The absorption limit obtained for the positron spectrum is $0{\cdot}23\pm0{\cdot}01$ g. per sq. cm. of Al, corresponding with a max. energy of $0{\cdot}72\pm0{\cdot}02$ Me.v. ^{18}F is thus formed by the reaction ^{19}F $(d, {}^3\mathrm{H})$ ^{18}F. Excitation function measurements, made by the powder technique, indicate a threshold at ~6 Me.v., and a Q val. of $-3{\cdot}2$ Me.v. for this reaction. The cross-section for the formation of ^{18}F from F under deuteron (8·8-Me.v.) bombardment is $3{\cdot}9\pm0{\cdot}4\times10^{-27}$ sq. cm. L. S. T.

Spontaneous fission of uranium. G. N. Flerov and K. A. Petrshak (*J. Physics U.S.S.R.*, 1940, **3**, 275—280; cf. A., 1940, I, 338).—A special type of tuned ionisation chamber has been constructed, and is used in conjunction with an amplifier for the investigation of ionisation produced by fission products of U. The sensitivity is 30—40 times that of an ordinary chamber. The fission of U nuclei in the absence of a neutron source has been verified. It is probably to be explained by the spontaneous fission of $^{238}_{92}$U nuclei of half-life 10^{16}—10^{17} years. A. J. M.

Angular distribution of shower particles. L. Landau (*J. Physics U.S.S.R.*, 1940, **3**, 237—242).—The total no. of all particles in a shower is given by an exponential factor previously calc. (A., 1938, I, 424) and a non-exponential coeff. The latter is calc., and an expression is obtained for the max. no. of particles in a shower. An expression for the angular distribution of particles in a shower is also deduced. The mean horizontal width of a shower at a given level is obtained. The width is almost independent of the path traversed by the shower and of the kind of particle generating it. In air the width is ~250 m. A. J. M.

(A) General classical theory of spinning particles in a Maxwell field. H. J. Bhabha and H. C. Corben. **(B) General classical theory of spinning particles in a meson field.** H. J. Bhabha (*Proc. Roy. Soc.*, 1941, **A, 178**, 273—314, 314—350; cf. A., 1940, I, 309).—(A) A complete classical theory of a spinning particle moving in a Maxwell field is given. The equations are consistent with the conservation of energy, momentum, and angular momentum, and thus contain the effect of radiation reaction on the motion of the particle.

(B) An exact theory of the motion of a point dipole in a meson field is given which takes into account the effects of the reaction of the emitted meson field. G. D. P.

Meson theory. D. Ivanenko (*J. Physics U.S.S.R.*, 1940, **3**, 417—419).—The meson theory explains the isotopic displacement of the spectra of certain elements which remains after the motion of the nucleus has been taken into account, since the meson theory leads to interaction between all elementary particles and not only between heavy nuclons. There will thus be an interaction between neutrons and electrons which explains not only the isotopic displacement but also the anomalous scattering of electrons by nuclei, observed by Bothe. The scattering of mesons due to their interaction with quasi-magnetic moments of neutrons is considered. A. J. M.

Problem of two plane waves in classical non-linear electrodynamics. A. A. Smirnov (*J. Physics U.S.S.R.*, 1940, **3**, 447—453).—Mathematical. The properties of a plane monochromatic light wave in space in which another plane monochromatic light wave is propagated are investigated according to the classical non-linear electrodynamics of Born and Infeld (A., 1935, 912). On the assumption that the fields of the waves are small compared with the crit. field, the solution is obtained in a first-order approximation showing that both a distortion of the fields of the initial waves, and the appearance of scattered waves with greatly changed frequencies and velocities of propagation, will occur. Tho effects are very small and unobservable experimentally. O. D. S.

Connection of the quantum ensemble with the Gibbs classical ensemble. II. D. Blochintzev and P. Nemirovski (*J. Physics U.S.S.R.*, 1940, **3**, 191—194; cf. *ibid.*, **2**, 71).—Mathematical. The conditions for the approximation of quantum statistics by classical statistics are discussed. L. J. J.

II.—MOLECULAR STRUCTURE.

Band spectrum of thallium bromide. H. G. Howell and N. Coulson (*Proc. Physical Soc.*, 1941, **53**, 706—713; cf. A., 1938, I, 431). Data and classifications of the bands of TlBr photographed in absorption and in emission for 3400—4500 A. are reported. An expression for the analysis of the main band system $1 \rightleftharpoons {}^1\Sigma^+$ is found. A very small but intense band system occurs, in emission only, at 3950 A.; the lower state is the upper state of the main system. Predissociation occurs in both systems and the unstable levels responsible are the upper levels of continua at 1900 and 3300 A. Other continua occur at 2700 and 2960 A. N. M. B.

Perturbations in the neighbourhood of the predissociation limit. B. I. Stepanov (*J. Physics U.S.S.R.*, 1940, **3**, 463—466; cf. A., 1941, I, 147).—Theoretical. The existence of small perturbations in the predissociation levels is attributed to interaction with both continuous and discrete levels. Theoretical predictions agree with observed perturbations near the predissociation limit in the spectra of CaH, N_2, Se_2, and S_2. O. D. S.

Spectroscopic observation on hydrocarbon flames in atomic oxygen. I. K. H. Geib and W. M. Vaidya. **II. Spectroscopic investigation of hydrocarbon flames.** W. M. Vaidya (*Proc. Roy. Soc.*, 1941, **A, 178**, 351—355, 356—369).—I. Flames of hydrocarbons burning in at. O were examined to see whether the C_2H_4 flame bands occur. They are found to be strong in C_6H_6 and C_2H_2, but weak and diffuse in C_2H_4. MeOH gives OH and CH bands and also " cool flame " bands, whilst CH_2O shows only the OH band at λ 3064. The C_2H_4 flame bands are not observed in the flame of C_6H_6 burning in at. H.

II. The materials examined include CH_4, C_2H_4, C_2H_2, and the intermediate products of their combustion, viz., MeOH, CH_2O, HCO_2H, MeCHO. The flames of the Bunsen and Méker burners were also examined and some observations were made on Et_2O, EtOH, MeCl, $CHCl_3$, and CCl_4. In general the outer cones give a spectrum identical with the CO flame spectrum whilst the inner cones show C_2, CH, OH, and the C_2H_4 flame bands. Prevalent theories of hydrocarbon combustion are discussed in the light of the spectroscopic evidence. G. D. P.

Infra-red absorption spectrum of acetone. D. Price (*J. Chem. Physics*, 1941, **9**, 725—726).—The infra-red absorption spectrum of gaseous $COMe_2$ has been measured over the frequency range 500—3000 cm.$^{-1}$, using CaF, NaCl, and KBr prisms, and 13 frequencies are recorded. J. W. S.

Sensitised chemiluminescence in solutions. B. Tamamushi (*Naturwiss.*, 1940, **28**, 722—723).—An intense blue glow is observed when luminol (3-aminophthalhydrazide) is oxidised in alkaline solution in the presence of hæmin as catalyst. If a fluorescent substance is added to the reaction mixture the colour of the glow is that of the fluorescent substance. This is an example of chemifluorescence, in which the fluorescence is excited not by external light but by the energy of the reaction in the solution. There are two possible explanations represented by the following schemes: (1) $L + \epsilon \rightarrow L^*$, $L^* \rightarrow L + h\nu$, $F + h\nu \rightarrow F^*$, $F^* \rightarrow F + h\nu'$; (2) $L + \epsilon \rightarrow L^*$, $L^* + F \rightarrow L + F^*$, $F^* \rightarrow F + h\nu'$ (L = luminol, F = fluorescent substance). The second is a case of sensitised chemiluminescence, and is the more probable, since the addition of another chemiluminescent substance, dimethyldiacridylium nitrate, to a mixture of luminol and hæmin gives the luminescence of the former and not of the latter, and with greater intensity. A definite concn. of fluorescent substance is required to extinguish the blue luminescence of luminol, but

as the concn. of the fluorescent substance is increased the luminescence due to it decreases in intensity and is ultimately completely extinguished. A. J. M.

Elementary oscillators and polarisation of photoluminescence. S. I. Vavilov (*J. Physics U.S.S.R.*, 1940, **3**, 433—442).—Theoretical. The polarisation of photoluminescence, and its dependence on the orientation of the electric vector of the absorbed light and of the direction of observation, are uniquely determined by the multipole order of the absorbing and scattering radiators, provided that the anisotropy of the absorbing system is not completely destroyed by collision or other causes before radiation. The polarisation distribution is calc. for linear oscillators, for the cases in which the absorbing and scattering radiators are respectively: dipole, dipole; quadrupole, quadrupole; dipole, quadrupole; and quadrupole, dipole. O. D. S.

Extinction of the fluorescence and photothermal decomposition of aniline. A. Vartanian (*J. Physics U.S.S.R.*, 1940, **3**, 467—478).—The extinction of the fluorescence of NH_2Ph vapour at 3 mm. pressure by O_2, NH_3, and H_2 has been studied. The pressures at which fluorescence is halved are 8 mm., 90 mm., and 250 mm. respectively for these gases. The high quenching, efficiency of O_2 is due to chemical reaction. When NH_2Ph vapour is superheated at temp. up to 400° and const. pressure (3 mm.) the fluorescence decreases linearly with temp. after correction has been made for the decrease in density with temp. At these temp. irradiation with the Mg spark, after filtering out the 2026 A. line, decomposes NH_2Ph giving NH_3, H_2, a substance or substances fluorescing in the visible, and solid products. The reaction is interpreted as a unimol. decomp. due to a chance accumulation at the bond (which is ruptured) of thermal energy sufficient to cause decomp. of the excited mol. O. D. S.

Concentrational depolarisation of the fluorescence of dye solutions. P. P. Feofilov and B. J. Sveschnikov (*J. Physics U.S.S.R.*, 1940, **3**, 493—505).—The variation with concn. of the polarisation of the fluorescence of glycerol solutions of Na fluorescein, eosin, rhodamine-*B* (**I**), and trypaflavin (**II**) has been studied in the presence of varying concns. of quenching agents ($NHPh_2$ and KI). As the quenching increases, polarisation of the fluorescence increases, tending to a const. val. for all concns. of the fluorescing mol., *i.e.*, concentrational depolarisation is diminished by a shortening of the life-time τ of the excited state by quenching. The dependence of the polarisation of the fluorescence of (**I**) on temp. confirms that concentrational depolarisation decreases with increased quenching, in this case due to the rise in temp. The complicated form of the depolarisation curve of (**II**) is ascribed to the balancing effects of concentrational depolarisation and the increase in polarisation due to the shortening of τ by concentrational quenching. Perrin's theory, which ascribes concentrational depolarisation to resonance transfer of energy between excited and normal dyestuff mols., is regarded as the most satisfactory interpretation of the phenomena. O. D. S.

Raman spectra of mono- and di-chlorobenzenes. H. Sponer and J. S. Kirby-Smith (*J. Chem. Physics*, 1941, **9**, 667—672).—Raman spectral data for gaseous PhCl and *o*-, *m*-, and *p*-$C_6H_4Cl_2$ and depolarisation factors for the Raman lines of liquid *o*-, *m*-, and *p*-$C_6H_4Cl_2$ are recorded. Assignments which include most of the lines in the gas are suggested. J. W. S.

Raman spectrum of di*tert.*-butyl ether. F. F. Cleveland (*J. Chem. Physics*, 1941, **9**, 722—724).—Raman displacements, estimated intensities, and depolarisation factors for liquid Bu^t_2O are recorded, and compared with similar data for Bu^{α}_2O and Bu^{β}_2O (A., 1940, I, 195). The observed displacements are assigned tentatively. J. W. S.

Relation between absorption spectra and chemical constitution of dyes. XIX. Mono- and poly-azo-dyes with a single auxochrome.—See A., 1942, II, 8.

Ionisation potentials of polyatomic molecules. T. M. Sugden, A. D. Walsh, and W. C. Price (*Nature*, 1941, **148**, 372—373).—The following vals. are recorded for first ionisation potentials: H_2O 12·56, MeOH 10·8, EtOH 10·7, PrOH 10·7, Me_2O 10·5, Et_2O 10·2, H_2S 10·42, MeSH 9·7, Me_2S 9·4, Et_2S 9·3, Pr^{α}_2S 9·2; NH_3 10·8, NH_2Me 9·8, $NHMe_2$ 9·6, NMe_3 9·4; CH_2O 10·83, MeCHO 10·181, $COMe_2$ 10·1, CH_2:CH·CHO 10·06, $Pr^{\alpha}CHO$ 10·19; CMe:CH 11·25, $(CH{:}C)_2$ 10·74; CH_2:$CHCl$ 9·95, $(CHCl{:})_2$ 9·61 (*cis*), 9·91 (*trans*); C_6H_6 9·19, anthracene 8·3, PhMe 8·77, xylene (*o*-, *m*-, and *p*-) ~8·3 e.v. Vals. given to 0·01 v. are spectroscopic, the others are electron impact vals. For H_2O, H_2S, CH_2O, and their alkyl derivatives, the electron removed is a non-linking $p\pi$ O (or S) electron. For NH_3 and the amines, the min. ionisation potential corresponds with a $2p_2(n)$ electron, which is non-linking with orbital perpendicular to HHH plane. In CMe:CH, $(CH{:}C)_2$, the halogenoethylenes, and the aromatic mols., π electrons of the double and triple linkings are involved. For MeCHO, CH_2:CH·CHO, and CHMe:CH·CHO, extensive Rydberg series were found in the vac. ultra-violet, giving limits (ionisation potentials) of 10·1811±0·0007, 10·057± 0·006, and 10·187±0·001 v., respectively. L. S. T.

Breakdown potentials in hydrogen, oxygen, nitrogen, nitric oxide, hydrogen chloride, hydrogen bromide, and hydrogen iodide. G. M. Kovalenko (*J. Physics U.S.S.R.*, 1940, **3**, 455—462).—Breakdown potentials have been measured in H_2, O_2, N_2, NO, HCl, HBr, and HI at a const. ratio of pressure to abs. temp., *i.e.*, with const. no. of mols. per c.c. of gas. Some data are given for the variation in breakdown potential with the no. of discharges previously made through the gas. The correlation of breakdown potential with the mol. wt., mean free path, ionisation potential, crit. temp., interat. distance, and heat of dissociation of the mol. is discussed. O. D. S.

Effect of *X*-rays on the breakdown strength and flashover voltage of certain dielectrics. E. A. Walker (*J. Appl. Physics*, 1941, **12**, 215—218).—Measurements of the reduction in breakdown strength of air, insulating oil, and yellow varnished cambric are given. The flashover voltage at a solid/air boundary increases slightly on exposure to *X*-rays. D. F. R.

Electric strength of gases. A. M. Bontsch-Bruevitsch, M. B. Glinka, and B. M. Hochberg (*J. Physics U.S.S.R.*, 1940, **3**, 327—332).—The electric strength of a no. of gases, chiefly F compounds (*e.g.*, SOF_2, SO_2F_2, SF_6, PF_3, BF_3, CCl_2F_2, CCl_3F, CF_4, and SiF_4) has been determined. There is no simple relationship between electric strength and ionisation potential or no. of atoms in the mol. Electric strength increases with increasing mol. wt. but no definite connexion between these can be traced. A. J. M.

Electrical conductivity of semi-conductors with an ionic lattice in strong fields. B. Davidov and I. Schmushkevitsch (*J. Physics U.S.S.R.*, 1940, **3**, 359—377).—Theoretical. The deviations from Ohm's law of electronic semi-conductors with an ionic lattice in a strong field are investigated. In addition to the interaction of electrons with the optical vibrations of the lattice, inelastic collisions (ionisation) must be taken into account. The mean energy of the electrons approaches 0·2 of the ionisation energy with increasing field, so that, unlike semi-conductors with an at. lattice, the electron mobility increases in the case of ionic lattices, in strong fields. The variation of mobility with field strength and temp. is different for low and high temp. The boundary dividing the ranges is $\theta = \hbar\omega_0/k$ (ω_0 is the limiting frequency of optical vibrations of the crystal). For $T < \theta$ and fields up to ~1000 v. per cm., the mobility is independent of the field, and Ohm's law holds; the mobility decreases exponentially with T. At $T > \theta$ and fields $< 10^5$ v. per cm. the conductivity is independent of the field and varies as $T^{-\frac{1}{2}}$. For fields $>10^5$ v. per cm. the conductivity increases with the field. Frohlich's theory of breakdown is discussed. A. J. M.

Theory of anomalous dispersion and dielectric losses in solids. W. Holzmüller (*Physikal. Z.*, 1940, **41**, 499—508).—Dielectric losses in polar solids are due to changes in the orientation of the polar groups among the various positions of min. energy; these changes occur by the combined action of thermal collisions and the electric field, and are therefore time-dependent. By introduction of certain relaxation times the dependence of ϵ and loss angle (δ) on frequency and temp. is explained, and ϵ and δ are related to the mean moment of the polar groups and their polarisability. A. J. E. W.

Variation of dipole moment of ethylene bromide and ethylene chloride with temperature. R. Linke (*Z. physikal. Chem.*, 1940, **B, 46**, 251—260).—Assuming the equilibrium between *cis*- and *trans*-forms to be a function of temp., the dipole moments of the *cis*-forms of $(CH_2Br)_2$ and $(CH_2Cl)_2$ have been calc. from the variation of the dipole moments of the equilibrium mixtures with temp. The dipole moments of monohalogeno-

derivatives are not greatly different from those of the dihalogeno-compounds. A. J. M.

Variation of dipole moment of *o*-chlorophenol with temperature, and the dipole moments of *p*-chlorophenol, *o*-anisidine, and the phenylenediamines. R. Linke (*Z. physikal. Chem.*, 1940, **B**, **46**, 261—269).—The dipole moment of *o*-$C_6H_4Cl\cdot OH$ varies with temp., but that of the other substances mentioned above does not. It is assumed that in the case of *o*-$C_6H_4Cl\cdot OH$ there is *cis–trans* isomerism, and the effect of temp. on the dipole moment is used to calculate the heat of transformation, which is 1200 ± 500 g.-cal. The particularly large effect of the substituents in this mol. on the moment is considered to be due to the occurrence of a H bond, and the effect of the CO linking on the position of the H atom; this is confirmed by considering the moments of *o*-$C_6H_4Cl\cdot NH_2$ and *o*-anisidine. In the case of *o*-$C_6H_4(NH_2)_2$ there is a considerable difference between the observed moment and that calc. on the assumption of free rotation. In the case of the *m*- and *p*-compounds there is free rotation. A. J. M.

Dipole moment in solution. G. R. Paranjpe and D. J. Davar (*Indian J. Physics*, 1941, **15**, 173—183).—The apparent electric moments of *o*-, *m*-, and *p*-$C_6H_4Me\cdot NO_2$ have been measured at 30° in C_6H_{14}, C_7H_{16}, CCl_4, C_6H_6, PhMe, CS_2, and $CHCl_3$. The results are used to verify the empirical relations of Müller, Sugden, and Jenkins and the theories of Frank and Higasi connecting the measured moment with its val. in the gaseous state. Extrapolation to $\epsilon = 1$ for the gaseous state does not lead to concordant vals. but extrapolation to $\epsilon = 1{\cdot}7$ leads to general agreement between the vals. derived from the various proposed relations. W. R. A.

Refractive index of lithium fluoride in the visible and infrared regions. H. Littmann (*Physikal. Z.*, 1940, **41**, 468—475; cf. Hohls, A., 1937, I, 402).—Vals. of n_F, n_D, and n_C at 21°, correct to ~2 p.p.m., are recorded for an artificial LiF prism. Vals. of n ($\pm$10—20 p.p.m.) at 1·0—3·0 μ., referred to the dispersion curve of quartz, are derived from dispersion measurements against the *C*-line. The temp. coeff. of n_D is also determined to $\pm$0·1 p.p.m. A. J. E. W.

Absorption of light and heat radiation by small spherical particles. I. Absorption of light by carbon particles. R. Ruedy (*Canad. J. Res.*, 1941, **19**, **A**, 117—125).—Mie's theory of scattering by small spherical particles leads to an expression whereby the absorption by small C particles (lamp-black), of diameter comparable with λ of incident light, can be calc. When the diameter is $<0{\cdot}2$ μ. the coeff. of absorption decreases towards the red and a cloud of such particles appears red or blue by transmitted or scattered light, respectively; for particles of diameter 0·3 and 0·4 μ. the reverse holds, but the % change is small. A. A. E.

Theory of the Plotnikov effect. T. Neugebauer (*Physikal. Z.*, 1940, **41**, 55—62).—The theory, which gives results in approx. agreement with experimental data, is developed for long-chain polymerides on the assumption that the effect is due to refraction and total reflexion at the boundaries of the macromols.; the type of process occurring at each boundary is determined by the orientation of the chain to the plane of polarisation of the incident infra-red beam. "Scattering reflexion" of the beam is due to multiple processes of the same nature, and depends on the chain-length of the polymeride. The Plotnikov effect is not a special type of Rayleigh–Mie scattering. A. J. E. W.

Scattering of light by pigment particles. D. H. Clewell (*J. Opt. Soc. Amer.*, 1941, **31**, 521—527).—An empirical scattering function correlating scattering with particle size is derived. Diffraction scattering accounts for the observed max. scattering of visible light by particles of size $\sim\lambda/2$. Long $\lambda\lambda$ may be scattered more effectively than short $\lambda\lambda$ by particles of 0·3—0·5 mμ. L. J. J.

Angular distribution of light scattered in liquids. L. H. Dawson and E. O. Hulburt (*J. Opt. Soc. Amer.*, 1941, **31**, 554—558).—Data are recorded for the intensities of polarised components of the light from a W lamp scattered by Et_2O, CCl_4, CS_2, C_6H_6 and H_2O, at angles 22·5—157·5°. The results are consistent with scattering by centres small compared with the λ, together with an additional scattering depending on the liquid. L. J. J.

Kerr effect and molecular order in highly compressed gase and liquids. E. Kuss and H. A. Stuart (*Physikal. Z.*, 1941, **42**, 95—105).—Methods for the study of relations between the gaseous and liquid states are discussed, with special reference to the partly ordered arrangement of mols. in liquids. Kerr const. (B) data are given for N_2, CO_2, and CH_4 at 25°, and CO_2 and C_2H_4 at 40°, with $p = 36$—420 atm. In CO_2 the p-dependence of B is similar above and below θ_c. The B vals. for CO_2 and C_2H_4 show considerable deviations from the Langevin-Born theory with $\rho > \rho_0$; a p-dependence of B in CH_4 and A (data not given) is also contrary to this theory. The results are used to examine the variation of rotation hindrance and internal field anisotropy in the fluids (cf. Peterlin and Stuart, A., 1940, I, 11). A. J. E. W.

Thermodynamic properties of a mixture of gas and radiation. N. R. Sen (*Indian J. Physics*, 1941, **15**, 219—227).—Mathematical. Emden's theorem on expansion and contraction of a polytropic gas mass with conservation of polytropic index is extended to the case of a variable polytrope, which under similar conditions, has the distribution of polytropic index unchanged. An interrelation of the polytropic indices N and n for (P, ρ) and (p, ρ) relations is derived, P and p being the total and gas pressures. Hence, a method is given for estimating the temp. distribution in a variable polytrope when its max. and min. polytropic indices are known. W. J.

Statistical mechanics of nearest neighbour systems. E. W. Montroll (*J. Chem. Physics*, 1941, **9**, 706—721).—Mathematical. For solids in which the intermol. forces are so short-ranged that practically all the potential energy of the system results from interaction between nearest neighbouring mols., the evaluation of the partition function is reduced to the solution of linear homogeneous operator equations. The theory is applied to a superficial treatment of two-dimensional ferromagnetic plates. J. W. S.

Simplest liquid crystalline substances. Chemical morphology of liquids. C. Weygand and R. Gabler (*Z. physikal. Chem.*, 1940, **B**, **46**, 270—275).—The simplest types of liquid cryst. compounds are the *p*-*n*-alkylbenzoic acids. The possible structure of the double mols. of the alkoxybenzoic acids (cf. Bennett *et al.*, A., 1939, II, 214) is discussed. The existence of an 8-ring with H as a member is not accepted, but the compounds are assumed to be similar in structure to the homologous diphenylpyridazines with a 6-ring. The cryst. solid and cryst. liquid fixed points for the *p*-*n*-alkoxybenzoic acids are given. A. J. M.

Determination of electric moments by the molecular beam method. H. Scheffers (*Physikal. Z.*, 1940, **41**, 89—97).—With an improved method of calculation the results of Estermann and Fraser (A., 1934, 15) lead to a val. for the dipole moment (μ) of HCl (0·91 D.) which is in satisfactory accord with ϵ data. Certain conditions are recommended for accurate μ measurements by the mol. beam method; the electric field strength (X) should be sufficient to reduce the intensity at the centre of the beam by ~25%. With mols. possessing a resolved μ val. along the axis of thermal rotation some of the mols. in the beam are undeflected, while the remainder are deflected symmetrically to either side; the deflexion is $\propto X$. This "linear" effect, which is $\gg$ the normal effect (deflexion $\propto X^2$), is investigated theoretically, and expressions are derived for the calculation of μ from appropriate measurements. A. J. E. W.

Linear electric field effect in the molecular beam experiment with ammonia. H. Scheffers (*Physikal. Z.*, 1940, **41**, 98—105).—An apparatus for the study of mol. beams of NH_3 is described. The results obtained confirm the occurrence of the "linear" deflexion (cf. preceding abstract), but the derived μ val. (~0·56 D.) is $\ll$ that obtained by the ϵ method. Reasons for the discrepancy are discussed. A. J. E. W.

Effect of temperature on the surface tension of liquids. J. Frenkel (*J. Physics U.S.S.R.*, 1940, **3**, 355—358).—Theoretical. The effect of temp. on surface tension is determined by considering the thermal motion of the surface as a superposition of capillary waves, as in Debye's theory of solid bodies. The theoretical result is in satisfactory agreement with the equations of Eötvös and Ramsay and Shields, but can be applied strictly only to simple monat. liquids, such as fused metals. The effect of adsorbed films on the surface tension is also considered. A. J. M.

New relation between the surface tension and the coefficient of compressibility of liquids. C. Sălceanu (*Z. physikal. Chem.*,

1940, **A**, **187**, 170—174).—Assuming that surface tension (γ) $\propto$ the no. of mols. per unit length, the equation $\gamma = K(Nd/M)^{\frac{1}{3}} . \beta^{-\frac{1}{3}}$ can be derived (β = coeff. of compressibility, K = const., and d, M, and N have their usual meaning). For most of 23 liquids the val. of K lies between 130 and 150×10^{-13}, but low vals. for AcOH, MeOH, EtOH, and PrOH suggest that there is an increase in the no. of mols. per unit length on account of dissociation. C. R. H.

III.—CRYSTAL STRUCTURE.

Refraction patterns of the surfaces of opaque and translucent solids. R. S. Rivlin and W. A. Wooster (*Nature*, 1941, **148**, 372).—Several coatings of Diakon are painted on the rough surface of the solid to form a cast, which is then peeled off and examined in the manner described previously (A., 1941, I, 132). L. S. T.

***X*-Ray criterion for distinguishing between lattice curvature and fragmentation.** E. Orowan and K. J. Pascoe (*Nature*, 1941, **148**, 467—468).—Rotation photographs of moderately extended Cd crystals show that *X*-ray methods can often decide whether local curvature of the lattice or disintegration into a mosaic of fragments is present. These photographs often contain very sharp spots; two corresponding spots on the same side of the equator are equally sharp, but the two corresponding spots reflected by the other side of the plane are smeared to form arcs. The dissymmetry of corresponding spots is explained by assuming that the lattice plane is curved. L. S. T.

Structures of thallium. H. Lipson and A. R. Stokes (*Nature*, 1941, **148**, 437).—Debye-Scherrer photographs of Tl (99·995%) at room temp. give a_0 3·4496$\pm$2 A. and c_0 5·5137$\pm$4 A. Above 230°, Tl is body-centred cubic, a_0 3·874$\pm$1 A., and not face-centred cubic (cf. A., 1931, 288). L. S. T.

***X*-Ray diffraction examination of material having the composition SiO.** H. N. Baumann, jun. (*Trans. Electrochem. Soc.*, 1941, **80**, *Preprint* 9, 75—77).—*X*-Ray studies on materials of the approx. composition SiO, produced by the reduction of SiO_2 or silicates, indicate that they are mixtures of SiO_2 and Si. J. W. S.

***X*-Ray diffraction pattern of tricalcium aluminate.** L. J. Brady and W. P. Davey (*J. Chem. Physics*, 1941, **9**, 663—666).—The diffraction pattern of very pure $3CaO,Al_2O_3$ has been determined with a new form of *X*-ray diffraction apparatus, in which the pattern is measured with a Geiger-Müller counter and recorded automatically in an intensity–angle graph. The unit cube has an edge of 15·235 A. and contains 264 atoms. J. W. S.

***X*-Ray and crystallographic studies of plant virus preparations.**—See A., 1941, III, 1077.

Magnetic susceptibility of titanium and zirconium. C. F. Squire and A. R. Kaufmann (*J. Chem. Physics*, 1941, **9**, 673—677).—The paramagnetic susceptibilities of Ti and Zr increase linearly with rising temp. from 20° K. to the temp. at which a crystal structure change occurs. The variations of the electrical conductivity, sp. heat, and linear expansion with temp. indicate that this structural change involves a change in electron configuration. J. W. S.

Magnetic and *X*-ray studies on titanium and zirconium with dissolved hydrogen. J. Filtzwilliam, A. Kaufmann, and C. Squire (*J. Chem. Physics*, 1941, **9**, 678—682).—H dissolved in Ti and Zr changes the crystal lattice of the metals from hexagonal close-packed to almost a face-centred cubic lattice. At room temp. the paramagnetic susceptibilities of Ti and Zr are increased and decreased, respectively, by dissolved H. The Fe (0·11%) present in the Zr used was pptd. out and regained its ferromagnetic property when H was dissolved in the Zr, kept for 1 hr. at 1000°, but redissolved again when the H was removed by heating at 900° in a vac. J. W. S.

Effect of temperature on initial susceptibility and coercive force of ferromagnetic crystals. M. V. Dechtjar and N. I. Andriuschin (*J. Physics U.S.S.R.*, 1940, **3**, 487—492).—The initial susceptibility χ in fields up to 0·18 oersted of deformed and tempered crystals of meteorite Fe (8% Ni, 0·5% Co) has been measured at temp. from 15° to 300° and 700°, respectively. In deformed crystals χ decreases with temp. in both the [110] and the [100] directions. In crystals tempered in H_2 at 500°, χ in the [100] direction increases with temp. up to 400° and falls to a min. val. at 600°, above which it again increases. In the [110] direction the dependence on temp. is similar, but the min., in this case at 500°, is more pronounced and the rise, above 500°, is steeper. The coercive force of tempered crystals decreases with temp. up to 300° in both the [100] and the [110] directions; above 300° it increases to a max., at 600° and 500°, respectively, and decreases rapidly at higher temp. O. D. S.

Amorphous state. XVIII. Electrical conductivity of substances in the amorphous and crystalline states. P. P. Kobeko, E. W. Kuvschinski, and N. I. Schischkin (*J. Physics U.S.S.R.*, 1940, **3**, 287—296).—The variation of sp. resistance (ρ) with temp. (T) of borax, Rochelle salt, and LiOAc has been determined for the substances in the amorphous and cryst. states. For the melts of these substances the portion of the function $\log \rho = f(1/T)$ is not linear. For substances in the vitreous state, *i.e.*, considerably supercooled liquid, the relation is linear at low temp. The coeff. B in the expression $\log \rho = A + B/T$ is almost the same for the above substances in the cryst. and vitreous states. The connexion between these results and *X*-ray structure is considered, and it is shown that Zachariasen's view (A., 1933, 12, 1107), that the arrangement of mols. in the lattices of silicate and borate glasses is the same as in the cryst. state, may be extended to all supercooled systems irrespective of their composition. Since B does not alter, any considerable change of the structure of a liquid with temp. is not possible. A. J. M.

Quantum theory of magnetostriction of ferromagnetic single crystals. S. V. Vonsovski (*J. Physics U.S.S.R.*, 1940, **3**, 181—190).—The temp.-dependence of the magnetostriction consts. of cubic Fe and Ni crystals is calc. on the basis of Bloch's quantum-mechanical model. Experimental data for Ni are in agreement with the theory when only spin-coupling interaction is taken into account, but in the case of Fe the spin–orbital coupling must be included. A generalised theory for binary ferromagnetic alloys is presented. L. J. J.

Artificial stress formation [in crystals]. A. W. Stepanov (*J. Physics U.S.S.R.*, 1940, **3**, 421—426).—If a scratch is made on the surface of a rock-salt crystal this acts as the origin of a stress. Breaking takes place at the scratch when the crystal is under external stress. It is the micro-defects of the surface and the plastic rotation of the lattice which play the leading part in the formation of such artificial stresses. A. J. H.

Twinning of Chile saltpetre under plastic strain. R. I. Garber (*J. Physics U.S.S.R.*, 1940, **3**, 179—180).—$NaNO_3$ crystals can be twinned by applying a shearing stress tangential to the twinning (110) plane. Concentrated loading produces an "elastic twinning" effect similar to that found with calcite (A., 1939, I, 285), but "arrested" twins are readily produced at room temp. The twin-crystal boundary appears to be several thousand at. layers thick. L. J. J.

Allotropes of tellurium by *X*-ray diffraction. H. Bose and B. B. Ray (*Indian J. Physics*, 1941, **15**, 233—240).—Pptd. Te is not amorphous but is the hexagonal variety in a finely-divided state, *i.e.*, it is the same as metallic Te. The diffraction patterns were taken at different temp. and results disprove the existence of two dynamic allotropes. Molten Te, on chilling, yields a fine powder which is not amorphous. The supposed increase in sp. heat on exposure to *X*-rays owing to a change in crystal structure is not supported. The *X*-ray pattern of liquid Te is given and discussed. W. R. A.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Anisotropy of electrical resistance of sodium in a magnetic field. Isotropy of the electron gas in alkali metals. E. Justi and J. Kramer (*Physikal. Z.*, 1940, **41**, 105—106).—The resistance of a Na crystal at 20·4° K., in a magnetic field of 33,200 G. perpendicular to the direction of current flow, is ~9—22% > the normal val., the increment passing through two diametrically opposed max. as the field is rotated through 360°. The anisotropy, which is also observed with K, is not detected at 78° K. It is deduced that the conductivity electrons in alkali metals are free, but that the electron gas

is not isotropic owing to the effect of " elastic anisotropy " (cf. Justi and Kohler, A., 1940, I, 103). A. J. E. W.

Galvanomagnetic experiments on the electrical conduction process in indium. A. Foroud, E. Justi, and J. Kramer (*Physikal. Z.*, 1940, **41**, 113—121).—Sp. resistance (ρ) data for In rods at 4·22—373° K., with transverse and longitudinal magnetic fields ($H_\perp$, $H_\parallel$) $\gtrsim$40 kG., are recorded. With $H = 0$ and $T < \sim\frac{1}{2}\Theta$ (Θ = characteristic temp.), ρ follows a T^3 law. The relative increase in ρ ($\Delta\rho_H/\rho_0$) due to a field is $\propto (H_\perp/r)^n$ ($r = \rho_T/\rho_\Theta$), where n is ~2 at low $H_\perp/r$ vals. but falls rapidly with $H_\perp/r > \sim$1000 kG. The effect of $H_\parallel$ is approx. half that of $H_\perp$. Kohler's rule (cf. A., 1938, I, 128) is verified over wide ranges of H, T, and residual resistance. $\mathrm{Log}(\Delta\rho_H/\rho_0) - \log(H_\perp/r)$ curves (" reduced Kohler diagrams ") eliminate temp. effects and enable the ρ–H relations in metals to be compared directly; such curves for Al and In differ only by a const. factor, and confirm the " type " theory of metallic conduction. A. J. E. W.

Electrical resistance of polycrystalline gold, lead, niobium, and tantalum in strong transverse magnetic fields at low temperatures. E. Justi (*Physikal. Z.*, 1940, **41**, 486—498; cf. preceding abstract).—ρ data are recorded for Au, Pb, Ta, and Nb at 4·22—78° K., with $H_\perp \gtrsim$40 kG. With Au $\Delta\rho_H/\rho_0$ approaches a saturation val. at high $H_\perp/r$ owing to high elastic anisotropy, but $\Delta\rho_H/\rho_0$ for Pb increases rapidly with $H_\perp/r$ without evidence of saturation. The effect of $H_\perp$ is very small with Ta and unmeasurable with Nb, an anomaly which is explained by reference to the crystal structure of Bi. The " type " theory of metallic conduction is correlated with the periodic table by reduced Kohler diagrams for a no. of metals. A. J. E. W.

Dielectric properties of glass cloth in compressed gases. B. M. Vul, G. M. Kovalenko, and J. M. Parnas (*J. Physics U.S.S.R.*, 1940, **3**, 321—326).—The breakdown voltage of glass cloth increases with increase of gas pressure (N_2 up to pressures of 16 kg. per sq. cm. and 50-cycle a.c. were used), but is < that of the pure gas gap of the same thickness. The breakdown voltage is unaffected by irradiating the glass cloth with radiations from Ra. The dielectric loss was also determined. Tan δ is independent of voltage and pressure and is ~0·001. The resistivity of glass cloth is $\sim 10^{15}$ Ω.-cm. A. J. M.

Electrical resistance and thermo-electric power of the transition metals. H. H. Potter (*Proc. Physical Soc.*, 1941, **53**, 695—705).—Measurements and their variations with temp. are tabulated and plotted for V, Ta, Nb, Ti, Zr, Rh, Ir, Cr, and Mo. Results are discussed in relation to the Mott–Jones theory; they cannot be described by the simple theory using d bands of simple shape. N. M. B.

Displacement caused by tension in the critical values of superconductivity for tantalum. N. E. Alexeevski (*J. Physics U.S.S.R.*, 1940, **3**, 443—446).—The variation of resistance with magnetic field in the neighbourhood of the transition to superconductivity has been measured for a Ta wire under tension up to 16—18 × 10^3 kg. per sq. cm., at temp. from 3·90° to 4·22° K. The crit. field increases linearly with tension, the effect being greatest at the highest temp. The crit. current also increases linearly with tension. The crit. field varies linearly with temp. at const. tension. The max. increase in crit. temp. is 0·125° K. for a tension 18 × 10^3 kg. per sq. cm. O. D. S.

Gyromagnetic effect in superconductors. I. K. Kikoin and S. V. Gubar (*J. Physics U.S.S.R.*, 1940, **3**, 333—354; cf. A., 1938, I, 442).—The Einstein-de Haas effect has been investigated for superconducting Pb, and is shown to be a general effect for all superconductors. Diamagnetic bodies could also have gyromagnetic properties. The numerical val. of the Landé factor obtained is $1 \pm 0{\cdot}03$, indicating that the magnetisation of a superconductor is not conditioned by electron spin, but by closed electron circuits. A. J. M.

Statistical computation of magnetic susceptibility. F. Kaner (*J. Physics U.S.S.R.*, 1940, **3**, 153—164).—A statistical method, based on Kirkwood's calculation of the partition function of a binary alloy, is developed and applied to the study of ferromagnetic substances and paramagnetic salts. The method accounts for the existence of two Curie points and an additional sp. heat above the Curie point, and indicates that magnetic susceptibility at low temp. is < that given by Heisenberg's formula, and tends to zero as the temp. tends to zero, in the case of paramagnetic substances. L. J. J.

Magnetic measurements on semiquinone radicals in solution. L. Michaelis (*J. Amer. Chem. Soc.*, 1941, **63**, 2446—2451).—A differential magnetometric method is described and used to confirm production of semiquinone radicals (causing greater susceptibility) by partial reduction of dyes. The dye may be reduced rapidly (thiazine), *e.g.*, by ascorbic acid, or slowly (oxonine), *e.g.*, by glucose. The max. concns. of free radicals thus discerned agree with these previously disclosed by potentiometric measurements. Dimerisation does not occur. R. S. C.

Magnetisation of matter by ultra-violet radiation. C. M. Focken (*Nature*, 1941, **148**, 438).—The results obtained by Ehrenhaft *et al* (A., 1941, I, 158) could not be confirmed. L. S. T.

Optical measurement of ultrasonic absorption in liquids. A. Lindberg (*Physikal. Z.*, 1940, **41**, 457—467).—A modification of Grobe's method for measurement of ultrasonic absorption coeffs. (α) (cf. A., 1938, I, 303), suitable for practical application, is described. The method is accurate to ~5%, but cannot be used with $\alpha > \sim$50 cm.$^{-1}$ α data are given for C_6H_6 and MeOH at 20°, with frequencies of 15—43 and 30—90 MHz. respectively; temp. coeffs. (10—25°) are also given for MeOH. A. J. E. W.

Ultrasonic dispersion and fracture velocity. A. Smekal (*Physikal Z.*, 1940, **41**, 475—480).—Structural imperfections in homogeneous solids may give rise to regions of ultrasonic dispersion; owing to the high dispersion frequency (~5 × 10^8 cm.$^{-1}$ in crystals to ~10^{11} cm.$^{-1}$ in inorg. glasses) these regions cannot be detected directly, but they are closely related to fracture propagation phenomena. The velocity of fracture is < the normal velocity of elastic waves, and depends on the structure of the solid. Certain fracture effects (including Wallner's " fracture lines ") are explained by the theory, which is fully confirmed by the results of Schardin *et al.* A. J. E. W.

Velocity of sound in liquids and chemical constitution. M. R. Rao (*J. Chem. Physics*, 1941, **9**, 682—685).—In any homologous series the const. R of the law $v^{\frac{1}{4}}M/d = R$, where v is the velocity of sound and M the mol. wt. of the liquid (cf. A., 1940, I, 434), follows the law $R = \alpha M + \beta$ where α is a general const. (~14) and β is a const. characteristic of the series. R is an additive function of the chemical structure and contributions attributable to C, H, O, Cl, and Br and the double linking are evaluated. J. W. S.

Specific heat of superconductive tantalum. K. Mendelssohn (*Nature*, 1941, **148**, 370).—A correction (cf. A., 1941, I, 457). L. S. T.

Heat capacities of molecular lattices. I. Introduction. II. Structure of metallic lithium. R. C. Lord, jun. (*J. Chem. Physics*, 1941, **9**, 693—699, 700—705).—I. Theoretical. The interpretation of the heat capacities of mol. crystals is discussed. The assumption that the lattice part of the mol. heat capacity can be represented by a single Debye function with the appropriate no. of degrees of freedom is expected to be valid except at temp. low relative to the characteristic temp. θ of the Debye function. The conversion of C_v into C_p for mol. lattices is discussed.

II. The failure of the heat capacity of Li to accord with the Debye equation for at. lattices is attributed to association into diat. mols. Assuming the vibration frequency of Li_2 to be 350 cm.$^{-1}$, as deduced from the band spectrum, the calc. heat capacity is in accord with the Debye equation. The implications of the theory in respect of the metallic properties of Li are discussed. J. W. S.

Thermal expansion of lead from 0° to 320°. A. R. Stokes and A. J. C. Wilson (*Proc. Physical Soc.*, 1941, **53**, 658—662).—Measurements by the high-temp. X-ray camera (cf. A., 1941, I, 200) for the variation with temp. of the lattice parameter of Pb are reported. The coeff. of expansion is deduced and equations for the results are found. N. M. B.

Heat transfer in helium II. P. G. Strelkov (*J. Physics U.S.S.R.*, 1940, **3**, 176—178).—The apparent thermal conductivity of liquid He II was estimated from the size of the cylindrical bubble around an electrically heated wire immersed in the liquid. The vals. obtained differed markedly according as the wire was free or pressed between two plates. L. J. J.

Thermal conductivities of tungsten and molybdenum at incandescent temperatures. R. H. Osborn (*J. Opt. Soc. Amer.*, 1941, **31**, 428—432).—Thermal conductivities (κ) of W and Mo filaments have been measured at 1100—2000° K. by an optical pyrometer method in which surface temp. of the filaments were determined at points in the neighbourhood of cooling junctions. κ for W varies linearly from 1·170 w. per (cm.^{2} °K. per cm.) at 1100° K. to 1·026 w. per (cm.^{2} °K. per cm.) at 2000° K., and κ for Mo varies linearly from 1·083 w. per (cm.^{2} °K. per cm.) at 1200° K. to 0·666 w. per (cm.^{2} °K. per cm.) at 1900° K. L. J. J.

Model experiments in flow channels with different [fluid] media. W. Bardili (*Physikal. Z.*, 1940, **41**, 63—76).—The principle of similitude is used to determine the relative streaming velocities (u) required for attainment of given Mach and Reynolds nos. (β, R) in air, H_2, He, NH_3, CO_2, C_2H_2, *iso*-C_4H_{10}, Et_2O, Hg, H_2O, and glycerol. The energy losses (N) corresponding with given β, R, and u vals. are also determined; high R and low N vals. are obtained when $\eta \times$ (kinematic viscosity)^2 is small, while high d and compressibility and low η favour low N for a given β val. The relative channel lengths giving equal N for given R and β vals. are also calc., and the possibility of simultaneous attainment of equal R and β vals. in model experiments is discussed. A. J. E. W.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Diffusion and thermal diffusion of hydrogen-deuterium, with a note on the thermal diffusion of hydrogen-helium. H. R. Heath, T. L. Ibbs, and N. E. Wild (*Proc. Roy. Soc.*, 1941, **A, 178**, 380—389).—The diffusion coeff., measured for H_2–D_2, is in agreement with theory. From measurement of the thermal separation of mixtures of the gases the repulsive force index is deduced; it is < the val. obtained from viscosity data. The force const. is determined from these observations and so the complete law of force operating in collisions between unlike mols. is obtained. Measurements of the thermal separation in H_2–He mixtures were made and the force index was determined. This pair of mols. is "harder" than H_2–D_2 (cf. following abstract.) G. D. P.

Thermal diffusion in hydrogen-deuterium mixtures. K. E. Grew (*Proc. Roy. Soc.*, 1941, **A, 178**, 390—399).—The thermal separation of H_2–D_2 mixtures in the temp. range −183° to 425° was measured. The thermal diffusion ratio so obtained gives a val. of the force index for the H_2 and D_2 fields in agreement with the val. obtained from viscosity data. This result, due to a revised method of calculation, removes a discrepancy noted by other workers (cf. preceding abstract). G. D. P.

Maximum boiling mixtures of chloroparaffins with donor liquids. R. H. Ewell and L. M. Welch (*J. Amer. Chem. Soc.*, 1941, **63**, 2475—2478).—35 new max. boiling mixtures of the type exemplified by the system $CHCl_3$–$COMe_2$ have been reported. Not only haloforms exhibit this behaviour but also chlorinated paraffins with 2 Cl in the α-position, or with one α-Cl and one or more β-Cl. Many esters, ketones, aldehydes, ethers, and *tert.* amines act as donor liquids in the formation of H bonds with the active H of the chlorinated paraffin. W. R. A.

Pressure-volume-temperature relations in solutions. VI. Apparent and partial volumes of sodium bromide dissolved in glycol and the energy-volume coefficients of the solutions at various pressures and temperatures. R. E. Gibson and O. H. Loeffler (*J. Amer. Chem. Soc.*, 1941, **63**, 2287—2295).—Sp. vols. at 25°, thermal expansions, and compressions of a series of solutions of NaBr in $(CH_2{\cdot}OH)_2$ have been measured. A table of vols. covering the pressures 1—1000 bars, the temp. 25—105°, and the concn. 0—25% NaBr has been compiled. First and second derivatives have been obtained and hence thermal expansibilities, compressibilities, P–T and E–V coeffs., and $(C_P - C_V)$ vals. for the solutions and apparent and partial vols., compressibilities, and thermal expansibilities of NaBr in solution have been derived. The E–V coeffs. are approx. independent of concn. in the range of P and T studied. The apparent vols. of NaBr are independent of temp. at const. vol. of the solution. Thermal expansibilities of $(CH_2{\cdot}OH)_2$ in the pure state and in solution at different pressures and temp. can be represented as a linear function of $1/(B + P)$. W. R. A.

Theory of solutions. III. Vapour pressure curves of selected binary systems in relation to volume changes on mixing and heats of mixing. K. Fredenhagen and E. Tramitz (*Z. physikal. Chem.*, 1940, **B, 46**, 313—378; cf. A., 1939, I, 516).—Exchange of thermal energy between mols. A and B in a two-component system cannot cause lowering of the v.p. of either, which can only arise from processes involving a decrease in the free energy of A and B. Such processes are mutual dilution (i), chemical reactions (ii), and changes in intermol. forces (iii). Case (i) arises when the vol. ($V_{A,B}$) and energy ($U_{A,B}$) of the components are additive; in this case Raoult's law and the distribution law hold over the whole range of mol. fractions ($C_2H_4Cl_2$–C_6H_6). For the case of unimol. reaction between A and B, the v.p. vals. are correlated with the dissociation const. (K) in the intermol. compound [case (ii); $COMe_2$–$CHCl_3$, Et_2O–$CHCl_3$, H_2O–HF], and with ΔV and ΔU vals., over the whole range of mol. fractions. The systems H_2O–NH_3, H_2O–HCN, and EtOH–*cyclo*hexane represent combinations of cases (ii) and (iii). L. J. J.

Measurement of tension in solutions. A. F. Scott ond G. M. Pound (*J. Chem. Physics*, 1941, **9**, 726—727).—Using an apparatus similar to that of Vincent (A., 1941, I, 179) the val. of the max. tension (t) prior to breaking has been determined for H_2O and aq. $Ca(NO_3)_2$. t decreases with increasing $[Ca(NO_3)_2]$, suggesting that the solute weakens the attraction between solvent mols. t varies almost linearly with the apparent mol. vol. of $Ca(NO_3)_2$, and by extrapolation it is deduced that the tension would become zero when the apparent mol. vol. is 66 c.c., approx. the mol. vol. of anhyd. $Ca(NO_3)_2$. J. W. S.

Viscosity of suspensions and solutions. E. W. J. Mardles (*Nature*, 1941, **148**, 345).—Solutions of colloids and crystalloids show the same viscosity behaviour as that described previously (A., 1940, I, 439) for suspensions. If the explanation given for suspensions is valid, then solvated ions are asymmetric, and during the flow of salt solutions and colloidal dispersions the particles become oriented. Curves for NaCl, $AlCl_3$, K oleate, tannic acid, kaolin, and mica dispersed in H_2O–EtOH show that the ratio η/η_0 increases with increase of η_0. L. S. T.

"Internal friction Wien effect" in electrolyte solutions. A. Deubner (*Physikal. Z.*, 1940, **41**, 110—111).—Calculation shows that a pressure difference of ~200 atm. between the ends of a capillary tube of length 1 cm. and diameter 0·01 mm. containing 0·0001M-$Ca_2Fe(CN)_6$ should reduce the η of the solution to that of pure H_2O. A. J. E. W.

Rate of diffusion of sulphonamide compounds. F. Hawking (*Quart. J. Pharm.*, 1941, **14**, 226—233).—After 24 hr. contact with agar containing Ehrlich's reagent at 35° the travel in cm. of a saturated solution is sulphanilamide 4·2, sulphapyridine 2·6, sulphathiazole 2·7, sulphadiazine 2·0, and sulphanilylguanidine 3·1. After 24 hr. contact with 15% gelatin at 15° the corresponding concn. 1 cm. away from the interface is 3·1, 1·5, 2·2, 0·45, 2·6 mg. per 100 c.c., respectively. The diffusion coeff. for these compounds in 15% gelatin at 15° is ~0·157 (cm., days). H. G. R.

Rate of formation of nuclei in supersaturated solutions as a means of determining the constitution of the solutions. I. Potassium chlorate solutions. II. Solutions of paraffin-chain salts. J. Stauff (*Z. physikal. Chem.*, 1940, **A, 187**, 107—118, 119—129).—I. An arrangement, consisting essentially of two differentially connected photo-electric cells, is described, whereby the appearance of each new nucleus in a solution is registered by a discontinuity in the photo-electric current. The rate of formation of nuclei in $KClO_3$ solutions was studied in relation to the degree of supersaturation and to the concn. The results are in agreement with modern theory, although, owing to lack of knowledge of some of the consts., an exact calculation of the mol. concn. is not yet possible.

II. The relation between rate of nucleus formation and concn. has been studied in solutions of Na laurate, palmitate, and tetradecyl sulphate. The results are consistent with theory where knowledge of the constitution of the solutions permits comparison. The existence of two kinds of micelle in paraffin-chain salt solutions is confirmed. F. L. U.

Solid solution. I. Elastic sphere model as applied to solid solutions and deviations from Vegard's rule. B. J. Pines (*J. Physics U.S.S.R.*, 1940, **3**, 309—319).—The distortion of the lattice by one dissolved atom is calc. using the elastic sphere model. The "elastic" distortion energy of the lattice and the change in linear dimensions of a disordered solid solution are calc. The latter is compared with experimental data on deviations from Vegard's rule that the lattice parameter of a solid solution varies linearly with concn. The calculation gives the correct sign and order of magnitude for the deviation except for the alloys of transition elements and of Ag and Au. The calc. vals. are, however, usually < those observed, and this discrepancy is considerable in the case of Fe–V and Fe–Cr alloys. In the case of Fe–V alloys this may be connected with the change of compressibility consequent on the building up of the 3*d* shell. A. J. M.

Determination of constitution diagrams with *X*-rays. C. S. Barrett (*J. Appl. Physics*, 1941, **12**, 385—394).—The fundamental principles of the determination of phase diagrams for alloys are reviewed. The advantages and disadvantages of the *X*-ray and other methods of investigation of phase equilibria are discussed. The location of phase boundaries by measurement of lattice parameters is described, and the difficulties associated with the method are considered. The investigation of ternary alloys is described and the method of minimising the work necessary in obtaining points on the diagram is given. A. J. M.

Photo-electric alloys of alkali metals. A. Sommer (*Nature*, 1941, **148**, 468).—The alloys of Cs and Rb with Bi and Sb most sensitive to light are those that correspond with the formula XY_3, where Y is the alkali metal. $SbCs_3$ has the highest photo-electric quantum yield; at the optimum λ of 4600 A., one electron is emitted for 5 incident light quanta. The sp. resistance of the Sb–Cs alloys rises sharply with an increase in the ratio Cs : Sb. The alloys of the $SbCs_3$ type can be regarded as semi-conductors, and they represent borderline cases between metallic alloys and ionic crystals. Alloys with a ratio Cs : Sb >3 : 1 have not been obtained. L. S. T.

Dilatometric study of the order–disorder transformation in copper–gold alloys. F. C. Nix and D. MacNair (*Physical Rev.*, 1941, [ii], **60**, 320—329).—Graphs of true coeffs. of thermal expansion plotted against temp. for previously well-ordered alloys containing 22, 25, and 30 at.-% of Au show a slow rise from −190° to ~50°, followed by a flat plateau to ~250°, then a rapid rise to a peak at the crit. ordering temp. θ_c, and finally a fall to a second flat plateau extending to ~450° above θ_c. The portion below the plateau can be represented by a Grueneisen equation if additivity is assumed for the consts. taken from the equation for pure Cu and Au. The plateau above θ_c disagrees with the Bethe–Peierls theory of the vanishing of short-range order. Curves for specimens previously quenched from above θ_c show min. similar to those in the comparable sp. heat curves of Sykes (cf. A., 1937, I, 74). N. M. B.

Transformation in eutectoid copper–aluminium alloys. V. Crystal structure of the martensite γ' phase. G. Kurdjumov, V Mirezki, and T. Stelletzkaja (*J. Physics U.S.S.R.*, 1940, **3**, 297—308).—*X*-Ray patterns of the γ' phase of the Cu–Al system (Al 13·5%) indicate that the Cu and Al atoms are arranged at the points of a hexagonal close-packed lattice with a 2·06 A., c/a 1·62. The γ' lattice is formed as the result of a martensite transformation of the ordered β phase solid solution, and it is possible by using this fact to calculate the dimensions of the superlattice of the γ' phase. By quenching a β phase single crystal it was transformed into the γ' phase, and pole figures were obtained for the main planes of the γ' lattice relative to the axes of the β crystal. The (0001) plane of the γ' lattice is parallel to (110) of the β phase, and the [110] direction of the former is parallel to [111] of the latter. The positions of the Al and Cu atoms in the γ' lattice are calc. using the rearrangement of a body-centred lattice into a hexagonal close-packed one, with the result that it is possible to choose a simpler cell for the γ' phase, belonging to the rhombic system, with 8 atoms in the unit cell. This is advisable because the arrangement of identical atoms in the calc. lattice lacks hexagonal symmetry. The dimensions of the rhombic cell are a 4·51, b 5·20, c 4·22 A., space-group V_h^{13}. A. J. M.

Beta region of the gold–cadmium alloy system. E. A. Owen and W. H. Rees (*J. Inst. Met.*, 1941, **67**, 141—151).—Quenched alloys with 38—62 at.-% of Cd have been examined by *X*-ray methods and the results have been combined with those previously obtained with alloys containing <36 at.-% of Cd in an equilibrium diagram. A rhombohedral phase α_3 extends from 46 to 48·5 at.-% of Cd at 200° and from 41 to 47·5 at.-% of Cd at 600°, and a cubic body-centred phase β from 50·2 to 54·5 at.-% of Cd at 300°; there is a fairly wide field of $\alpha_2 + \alpha_3$ and a narrower field of $\gamma_3 + \beta$, the former becoming more restricted and the latter broader with rise in temp. The β phase has an ordered structure and in quenched alloys rapidly decomposes at room temp. to a more complex structure. A. R. P.

Alpha solid solutions of the zinc–silver system. II. Lattice parameters with notes on the ζ phase. H. Lipson, N. J. Petch, and D. Stockdale (*J. Inst. Met.*, 1941, **67**, 79—85).—Precision measurements of the Ag lattice gave a = 4·0775 A. after correction. Vals. of a for 20 Zn–Ag alloys with up to 35 at.-% of Zn are tabulated and the observed d compared with those calc. from a; only with the alloys with 3, 17, and 29 at.-% of Zn were the two vals. in complete agreement, the calc. vals. for other alloys being < the observed, indicating the presence of up to 20 vacant sites per 10,000 unit cells. The val. of a is related to the at.-% of Zn present (C) by $a = 4{\cdot}0775 - 1{\cdot}82 \times 10^{-3}C - 1{\cdot}81 \times 10^{-6}C^2$. *X*-Ray examination of powders of alloys with 37—41 at.-% of Zn after prolonged annealing at 300° gave results not in accordance with the accepted equilibrium diagram. A. R. P.

Constitution of alloys of aluminium with magnesium and silicon. H. W. L. Phillips (*J. Inst. Met.*, 1941, **67**, 257—273).—Al, Si, and Mg_2Si form a ternary eutectic at 551°, Si 12·97, Mg 4·97%, and Al, Mg_2Si, and Mg_2Al_3 a ternary eutectic at 450°, the composition of which could not be determined. The surface of separation of the Al–Mg_2Si binary complex is ridge-shaped with a flat max. at 595°; the ridge coincides with the Al–Mg_2Si quasibinary line only where it intersects the binary valley and lies on the Mg side of this line in Al-rich alloys. Free Si does not disappear at this line but requires an excess of Mg for its suppression; in alloys with excess of Si the Al-rich phase contains little Mg and changes only slightly in composition during freezing, but with excess of Mg Al takes increasing quantities into solid solution as freezing proceeds. With slow cooling free Si appears in binary Si–Al alloys at Si 0·2%, and Mg_2Al_3 in binary Mg–Al alloys at Mg 4·25%. In the ternary system addition of 0·1% of Si to Mg–Al alloys or of 0·1% of Mg to Si–Al alloys causes separation of Mg_2Si, the solubility of which in Al is therefore ~0·2%. A. R. P.

Constitution of alloys of aluminium with magnesium and iron. H. W. L. Phillips (*J. Inst. Met.*, 1941, **67**, 275—287).—Al, $FeAl_3$, and Mg_2Al_3 form a ternary eutectic at 451°, Mg 33, Al 67% with very little Fe. The binary Al–Mg_2Al_3 eutectic valley slopes towards the Al–Mg axis with increasing % Mg and with 20—30% of Mg the primary $FeAl_3$ field is entered with only 0·25% of Fe. Under the conditions studied Al dissolves <0·01% of Fe and ~4% of Mg; Fe slightly reduces the solubility of Mg but Mg has little effect on that of Fe. The ternary alloys are very subject to undercooling and segregation, $FeAl_3$ being easily undercooled and Mg_2Al_3 making its appearance at Mg contents well below equilibrium solubility. Parts of the ternary diagram and several sectional diagrams are given. A. R. P.

***X*-Ray investigation of aluminium–cobalt–iron system.** O. S. Edwards (*J. Inst. Met.*, 1941, **67**, 67—77).—The system has been examined up to 50 at.-% of Al; there is a small α (face-centred cubic) field around the Co corner, an extensive β (body-centred cubic) field extending from the Fe corner, and between them a medium-sized ($\alpha + \beta$) field which broadens out towards the Co–Al side of the ternary diagram. In alloys quenched from 800° there appears to exist a face-centred cubic α' phase containing 4 atoms per unit cell; this may be the metastable compound Co_3Al which normally decomposes at >800° but appears to be more stable in the presence of Fe. A. R. P.

***X*-Ray study of the iron–copper–nickel equilibrium diagram at various temperatures.** A. J. Bradley, W. F. Cox, and H. J. Goldschmidt (*J. Inst. Met.*, 1941, **67**, 189—201).—From *X*-ray powder photographs of slowly cooled and quenched

Fe–Cu–Ni alloys equilibrium diagrams have been constructed for 20°, 750°, 850°, 950°, and 1050°; the diagram for 20° confirms the work of Köster and Dannöhl (A., 1936, 152). The α–(α + α′) phase boundary rapidly approaches the Cu–Fe side with rise in temp. and the sharp inflexions at the Cu end of the boundary line almost disappear at 950°.
A. R. P.

Effect of temperature and pressure on the solubility of chlorine monoxide in water. C. H. Secoy and G. H. Cady (*J. Amer. Chem. Soc.*, 1941, **63**, 2504—2508).—The aq. solubility of gaseous Cl_2O has been measured at five temp. between 3·5° and 20° over a range of pressures and the equilibrium const. (K) for the reaction $2HOCl_{aq.} = Cl_2O + H_2O_{liq.}$ has been evaluated for each temp. Plotting K against $1/T$ indicates that the heat of dissolution of Cl_2O increases rapidly with temp. from 9300 g.-cal. at 5° to 16,000 g.-cal. at 18°. Several approx. vals. of thermodynamic consts. have been derived.
W. R. A.

Miscibility gap in the system acetone–carbon disulphide. K. Clusius and W. Ringer (*Z. physikal. Chem.*, 1940, **A, 187**, 186—194).—Investigation of the heat of mixing of $COMe_2$ and CS_2 has shown that at temp. $< -50°$ there is a region of immiscibility. The miscibility curve is unsymmetrical, the greater portion of the gap being on the CS_2-rich side. The upper crit. temp. and composition are 51·3° and 66·2 mol.-% of CS_2, respectively.
C. R. H.

Solubility relationships of salts. F. J. Garrick (*Phil. Mag.*, 1941, [vii], **32**, 353—364).—In a series of salts in which the solubility (s) differences are not too small the order of increasing s is that of increasing vals. of $S = W - U$, where W and U are the electrostatic hydration and lattice energies, respectively. W is expressed as a function of the valencies (z_+, z_-) and "corr." radii ($r'_+ = r_+ + 0{\cdot}25$, $r'_- = r_- - 0{\cdot}25$ A.) of the ions, and it is found that: (*a*) increase of z_+ and z_- in the same ratio increases s; (*b*) decrease of r'_+ and r'_- in the same ratio decreases s; (*c*) for salts of symmetrical valency type s is min. when $r'_+ = r'_-$; (*d*) for salts of valency type 1 : 2 s is min. when $r'_{biv.} = \sim 1{\cdot}2 r'_{univ.}$. Data for alkali and alkaline-earth halides, perchlorates, and sulphates confirm the theory for inert-gas type ions and polyat. ions with approx. spherical symmetry, but other ions show abnormalities.
A. J. E. W.

Distribution of di- and tri-methylamines between chloroform and water at 25°. W. A. Felsing and E. Ball (*J. Amer. Chem. Soc.*, 1941, **63**, 2525; cf. A., 1933, 898).—The true distribution coeff. is $2{\cdot}75 + 0{\cdot}109c_2$ for $NHMe_2$ and $0{\cdot}45 + 0{\cdot}021c_2$ for NMe_3 (c_2 = amine concn. in $CHCl_3$ layer), at aq. concns. up to 4M. and 3M., respectively.
W. R. A.

Simple derivation of Langmuir's adsorption isotherm. H. Dunken (*Z. physikal. Chem.*, 1940, **A, 187**, 105—106).—The expression is derived by equating the rates of adsorption and desorption at equilibrium, as for a reaction of the type $A + B \rightleftharpoons AB$.
F. L. U.

Adsorption in photographic development. I. Non-adsorption of organic developers to metallic silver. E. S. Perry, A. Ballard, and S. E. Sheppard (*J. Amer. Chem. Soc.*, 1941, **63**, 2357—2361).—The determination by ultrafiltration of the adsorption of 0·01N-quinol (**I**) and 0·01N-*p*-$NHMe{\cdot}C_6H_4{\cdot}OH$ in an atm. of H_2 to colloidal Ag in aq. gelatin containing a borate–nitrate buffer, $p_H \sim 9$, is described. In contrast with other data (cf. A., 1934, 1079) 99·56% of (**I**) and 99·77% of (**II**) were recovered. The bearing of the observed results on the theory of photographic development is discussed. Preliminary experiments with Ag_2S did not show any adsorption of (**I**) or (**II**).
W. R. A.

Molecular surface energy of hydrocarbon oils.—See B., 1941, I, 529.

Thickness of the rigid water film at a quartz–water interface from a measurement of Newton's rings. W. G. Eversole and P. H. Lahr (*J. Chem. Physics*, 1941, **9**, 686—689).—From measurements of the radii of successive Newton's rings obtained with a quartz lens and disc before and after the evaporation of a H_2O layer, the thickness of the H_2O film on each surface is found to be ~100 A.
J. W. S.

Friction between a liquid surface and a solid not wetted by it. D. S. Subrahmanyam (*Indian J. Physics*, 1941, **15**, 191—208).—If the narrow, uniform stem of an oscillating float is coated with paraffin wax, the oscillations are damped more quickly than when it is clean, and the val. of the logarithmic decrement increases as the amplitude decreases. On the assumption that this effect is due to friction between the solid and the liquid, analysis of the oscillations gives ~15 dynes as the limiting kinetic frictional force per cm. of the line of contact. The val. of this friction decreases at low velocities and when the H_2O surface is contaminated.
W. R. A.

Teaching theory of ideally dilute solutions. C. Wagner (*Z. physikal. Chem.*, 1940, **B, 46**, 379—386).—A purely thermodynamical method of deriving Raoult's law and van 't Hoff's expression for the osmotic pressure of dil. solutions from Henry's distribution law, suitable for instructional purposes, is described.
L. J. J.

Equilibrium in aërosols. II. Aërosol of ammonium chloride. I. D. Gurevitsch and N. A. Filimonov (*Kolloid. Shurn.*, 1941, **7**, 53—58; cf. A., 1941, I, 39).—The particles in aërosols produced by mixing damp air with NH_3 and HCl, or with NH_4Cl and HCl, contain amounts of H_2O that would be in equilibrium with the given NH_4Cl–HCl mixture and the H_2O v.p. in the air. The liquid phase of aërosols is in equilibrium with the vapour phase, and no special theory of the particle structure is necessary.
J. J. B.

Preparation of hydrosols by freezing. T. J. Shea, W. E. Dooley, and C. Schwob (*J. Amer. Chem. Soc.*, 1941, **63**, 2531–2532).—The prep. of electrolyte-free charcoal hydrosol by the alternate freezing and melting of a paste of wet charcoal and final mixing with a large vol. of H_2O is described.
W. R. A.

Solvation in disperse systems. XIII. Stabilisation of zinc oxide suspensions in media of various polarities. V. Margaritov (*Kolloid Shurn.*, 1941, **7**, 47—52).—The rate of sedimentation of ZnO in C_6H_6 decreases when the concn. of ZnO increases from 2 to 20%. Small additions of stearic acid (**I**) (up to 0·25%) lower the rate below 6% of ZnO; at higher [ZnO] the apparent rate of sedimentation is that of contraction of the sediment; this contraction is favoured by (**I**) since it destroys the structure of the sediment. The apparent radius of ZnO particles in C_6H_{14}, C_6H_6, and $PhNO_2$ is strongly reduced by (**I**), that in *iso*-$C_5H_{11}{\cdot}OH$ is slightly reduced, and that in NH_2Ph raised by (**I**). Paraffin wax, which does not stabilise ZnO in C_6H_6, intensifies the stabilising effect of (**I**) These phenomena are explained by orientation of polar mols. at the ZnO surface.
J. J. B.

Swelling of clay. II. A. S. Korshuev and Z. L. Borisova (*Kolloid. Shurn.*, 1941, **7**, 59—65; cf. A., 1941, I, 43).—The swelling of various clays is measured. The increase of vol. has a max. in 0·0001—0·00001N-NaCl, 0·1N-Na_2SO_4, or 0·1N-Na_2CO_3. Ca salts reduce the swelling.
J. J. B.

Thixotropy of laminar films of aluminium and zinc hydroxides. N. G. Koltaschev (*Kolloid. Shurn.*, 1941, **7**, 23—33).—Films of $Al(OH)_3$ and $Zn(OH)_2$, produced by passing NH_3 over saturated solutions of $KAl(SO_4)_2$ or $ZnSO_4$, were dried at 75° until their solid content was 10%, mixed with H_2O, and the time of their thixotropic gelation was determined. It was, *e.g.*, 1 min. for a 2·5% suspension of $Zn(OH)_2$ or a 2·3% suspension of $Al(OH)_3$. When the films were separated by sedimentation into fractions of various particle size, the concn. c' at which the gelation time was 1 min. was higher for coarse than for finely dispersed fractions. By displacing H_2O with other liquids thixotropic suspensions in C_6H_6, PhMe, EtOH, and $CHCl_3$ were prepared; for these c' was inversely $\propto$ the mol. surface energy of the solvent.
J. J. B.

Colloid and semi-colloid solutions of highly polymeric substances and their hydrolysis products. A. M. Almazov (*Kolloid. Shurn.*, 1941, **7**, 67—88).—The viscosity η of aq. solutions of sol. starch (**I**), amylodextrin (**II**), erythrodextrin (**III**), achroodextrin (**IV**), and glucose (**V**) increases with concn. first linearly, and at higher concn. more rapidly. The η of starch solutions increases rapidly with concn. The mol. wt. calc. by the equation of Biltz is for starch 165,500, for two (**I**) 13,500 and 9000, for (**II**) 12,350, for (**III**) 4000, and for (**IV**) 2900. 0·1N-KCl reduces the η of 5% solutions of (**I**) by 2—8%, of (**II**) by 7%, of (**III**) by 1·65%, of (**IV**) by 1·14%, and of (**V**) by 1·00%. The electrical conductivity κ of commercial dextrin has a max. at 30 g. per 100 c.c., and κ of other dextrins increases with concn. at low concns. rapidly and at high concns. slowly. κ of 0·1N-KCl is lowered by dextrins etc.; 5 g. per 100 c.c. cause a lowering by 8—10%; (**V**) is more active than (**II**). The lowering of κ of KCl in

isoviscous solutions is the larger, the smaller is the mol. wt. of the non-electrolyte. The lowering by commercial dextrin has a max. at 0·03—0·05N-KCl. The κ of LiCl and NaCl is lowered by dextrin to the same extent as that of KCl. The rule $\kappa\eta$ = const. is not valid in presence of colloids; colloid solutions have a structure which affects κ and η in different ways. J. J. B.

Electrical properties of solids. IX. Dependence of dispersion on mol. wt. in the system polyvinyl chloride–diphenyl. X. System polyvinyl chloride–tetrahydronaphthalene. R. M. Fuoss (*J. Amer. Chem. Soc.*, 1941, **63**, 2401—2409, 2410—2413; cf. A., 1941, I, 202).—IX. The fractionation of polyvinyl chloride (I) by dissolution in mesityl oxide and $COMe_2$ and pptn. by MeOH is described and vals. of the intrinsic η of the fractions in $COMe{\cdot}C_5H_{11}$ are determined. Dielectric consts. and loss factors at from 60 to 10,000 cycles per sec. are given for (i) different fractions of (I) plasticised with 20% of Ph_2 at 45°, 55°, and 75°, and (ii) unfractionated polymerides of different average mol. wt., a range of five to one in mol. wt. being covered. Results agree with the assumptions that (*a*) the dipole moment per monomeride unit (μ) in a linear polymeride of the type $(-CH_2{\cdot}CHX-)_n$ is independent of the degree of polymerisation and (*b*) the most probable relaxation time as measured by the frequency of max. absorption at a given temp. $\propto$ the degree of polymerisation.

X. Dielectric consts. and loss factors, at from 60 to 10,000 cycles, of (I) plasticised with 8 to 40% of tetrahydronaphthalene (II) over the temp. range 5—80° have been determined. μ per $(CH_2{\cdot}CHCl)$ with increasing concn. of (II) approaches 1·73 D., the theoretical limiting val. for a linear polymeride of alternating structure assuming free rotation, and becomes independent of temp. with increasing temp. Positive deviations in μ vals. at high concns. of (I) or low temp. are explained qualitatively as an increase of average moment due to configurations in which the chain mols. are not in their most probable state. W. R. A.

p_H changes in solutions of polyacrylic acid irradiated with *X*-rays. L. Holzapfel (*Naturwiss.*, 1940, **28**, 254—255).—The p_H changes of solutions of polyacrylic acid of various concns. when irradiated with *X*-rays are reversible, *i.e.*, the p_H returns to its original val. after some time. The variation of p_H with duration of irradiation was also investigated. There is a rhythmic variation of p_H with time analogous to periodic pptn. by *X*-rays and ultra-violet light. No change in p_H was observed when solutions of polymethacrylamide were irradiated with *X*-rays. A. J. M.

Properties of alginic acid. II. Ammonium alginate as protective colloid. J. K. Novodranov and E. K. Smirnova (*Kolloid. Shurn.*, 1941, **7**, 89—94).—NH_4 alginate reduces the rate of sedimentation of Ca arsenate (I). Stable suspensions are obtained, *e.g.*, by mixing 1 g. of (I) with 2·5 g. of Na alginate, 7 c.c. of N-HCl, and 17 c.c. of N-aq. NH_3, or 50 g. of (I) with Na alginate 3·4 g., N-HCl 17·5 c.c., and N-aq. NH_3 27·5 c.c. J. J. B.

Mechanism of gelation of lyophilic colloids (gelatin). I. I. Sokolov (*Kolloid. Shurn.*, 1941, **7**, 39—46).—An attempt was made to determine the structure of gelatin sols and gels by pptn. with EtOH. *X*-Ray examination of the ppts. obtained revealed "cryst." spacings (11·3 and 2·8 A.) in a 10% gel, weak spacings in a 10% or 5% sol, and none in a 1% sol. Gelation involves a more perfect orientation of gelatin chains; a lattice structure is more stable than the random distribution of chains. J. J. B.

Structural properties of coagulates. Volume of silver iodide coagulates. B. G. Zaprometov and E. I. Smoligina (*Kolloid. Shurn.*, 1941, **7**, 13—22).—The rate of sedimentation of 0·87% AgI sol prepared in presence of an excess of KI is almost const. when the sol is coagulated by KNO_3 or K_2SO_4; it increases during coagulation when $Cu(NO_3)_2$ or $CuSO_4$ is used. The sedimentation vol. regularly decreases in the course of coagulation by K salts, Al salts, and 0·02—0·1N-Cu salt solutions; in presence of 0·01N-$CuSO_4$ or -$Cu(NO_3)_2$ it first increases since the coagulation of sol particles is faster than the aggregation of the sediment, and then remains const. or slowly decreases. J. J. B.

Factors influencing flocculation and precipitation. Theory and variables. E. M. Beavers, J. E. Magoffin, and F. K. Cameron (*Text. Res.*, 1940, **11**, 23—29).—The close relationship between the phenomena associated with the flocculation and pptn. of a colloidal dispersion is indicated. Existing work relevant to both processes is discussed, and the variables which influence them are indicated. J. G.

Plant virus preparations.—See A., 1941, III, 1077.

Dialysis potential.—See B., 1941, I, 511.

VI.—KINETIC THEORY. THERMODYNAMICS.

Chemical equilibria of thermal associations. A. Wassermann (*Proc. Roy. Soc.*, 1941, **A, 178**, 370—379).—Five gaseous thermal reactions of the type $a + b = c$ are discussed. The equilibrium const. K of an association can be expressed in two ways by formulæ of the type $K = W\exp(-\Delta E/RT)$; the factors W and ΔE in this relation are computed and the contributions of the internal vibrations of the reactants deduced. G. D. P.

Structure, properties, and mode of formation of inorganic compounds of high mol. wt. of the type of the heteropoly-acids (phosphotungstic and metatungstic acids). G. Jander (*Z. physikal. Chem.*, 1940, **A, 187**, 149—160).—A general review of the structure and properties of heteropoly-acids is given. Data are recorded for the dialysis coeffs. in presence of 1·0N- and 2·0N-$NaNO_3$ of $Na_5[HW_6O_{21},aq.]$ (I) and $Na_6[H_2O_4(W_3O_9)_4,aq.]$ (II) at various acidities and after ageing. With increasing p_H and dilution the (II) ion is transformed into two (I) ions according to the scheme $[H_2O_4(W_3O_9)_4,aq.]''''' + 8H_2O \rightleftharpoons [(OH)_3(W_3O_9)_2,aq.]''' + 6H_2O \rightleftharpoons 2[H_3W_6O_{21},aq.]''' + 6H_2O \rightleftharpoons 4H^{\cdot} + 2[HW_6O_{21},aq.]''''' + 6H_2O$. As the p_H is further increased $[HW_6O_{21},aq.]'''''$ splits up into $H^{\cdot}$ and $(WO_4,aq.)''$ which is stable in alkaline solutions. The time for equilibrium to be established depends on $[WO_3]$ and on the method of preparing the solution. Although $H^{\cdot}$ are liberated during hydrolysis, the p_H of (II) solutions is increased on keeping because $H_6[H_2O_4(W_3O_9)_4,aq.]$ is a stronger acid than $H_5[HW_6O_{21},aq.]$. C. R. H.

Interaction of aldoses with α-amino-acids or peptides. III. Determination of equilibrium constants. IV. Percentage combination. V. Continuous back-titration of the system to its initial p_H. M. Frankel and A. Katchalsky (*Biochem. J.*, 1941, **35**, 1024—1027, 1028—1033, 1034—1038; cf. A., 1939, II, 10).—III. Assuming that the reaction between the aldose and the NH_2-acid is bimol. and occurs with the undissociated aldose and the NH_2-acid anion, equilibrium consts. for glucose with glycine, alanine, leucine, and several simple peptides are calc. from potentiometric measurements between p_H 7 and 9. The val. of the equilibrium const. is determined mainly by the nature of the terminal NH_2-acid group of the peptide bearing the free NH_2.

IV. The extent of the combination between glucose and the NH_2-acids and peptides can be calc. from the p_H depression caused by the addition of the sugar. Vals. thus obtained are verified by determination of the free NH_2 (Van Slyke). At equilibrium the extent of reaction increases to a max. with increasing p_H.

V. The amount of alkali required to keep an aq. mixture of glucose and glycine at its original p_H is not a direct measure of the amount of the reaction product. There is a max. in the plot of total alkali added at equilibrium against initial p_H, but whereas the max. for glycine is at p_H 9, that for glycylglycine is at 7·5—8. This difference is explained by the difference in the acid dissociation consts. of the two substances and by the difference in the equilibrium consts. of their reaction with glucose. A. L.

Association of camphor with phenol and cresols. A. W. Francis (*J. Amer. Pharm. Assoc.*, 1941, **30**, 229—240).—The f.p. curves, *d*, partial solubilities in H_2O, partial v.p., temp. effects on mixing liquid solutions, and cryoscopic mol. wt. determinations were investigated. Equimol. mixtures of camphor (I) and phenol (II), and (I) and *o*-cresol, have m.p. −12° and −18°, respectively. There appear to be $\not<$ two complexes in mixtures of (I) and (II) or *o*-, *m*-, or *p*-cresol, the two complexes with 1 and 2 mols. of (II) or cresol per mol. of (I) predominating. The 1 : 1 complex predominates with (I)–(II) and the 1 : 2 complex with (I)–cresol. All the complexes are readily dissociated. An equimol. mixture of (I) and cresol contains 6—9% of free cresol, whilst in a 20% mixture with (I), there is 1·5% of free *m*-cresol. F. O. H.

Electrolytic dissociation of citric acid in sodium chloride solutions. B. Adell (*Z. physikal. Chem.*, 1940, **A**, **187**, 66—78).—The classical dissociation consts. K_c', K_c'', and K_c''' of citric acid were determined at 18° by measuring potentiometrically the [H·] vals. in buffer solutions of known ionic strength containing NaCl. The results are combined with those of Bjerrum and Unmack for the corresponding thermodynamic consts. K_a to give the activity coeffs. of the several species. K_c/K_a vals. for the isomeric univalent anions are calc. F. L. U.

Electrolytic dissociation in nitric acid as studied by Raman effect. N. R. Rao (*Indian J. Physics*, 1941, **15**, 185—189).—The intensities of the 1050 cm.$^{-1}$ lines, due to NO_3' ions, from equimol. solutions of $NaNO_3$ and HNO_3 (2·3—14·85M.) have been compared. $NaNO_3$ is assumed to be completely dissociated at all concns. At low concns. of HNO_3 the increase of dissociation with dilution is small and $\ll$ in conc. solution. This is attributed to an increase in H· ions at low concns. favouring the reaction $H· + NO_3' \rightarrow HNO_3$. W. R. A.

Phase equilibria in the two-component system, ethylene–propylene, in the critical temperature region. W. G. Schneider and O. Maass (*Canad. J. Res.*, 1941, **19**, **B**, 231—240).—For a 1 : 1 C_2H_4–C_3H_6 mixture d_c is 0·230 g. per c.c. and θ_c is 58·30±0·05°. For mass–vol. ratios > or <0·230, at const. vol., the temp. of liquid disappearance was respectively < or >58·3°. Without stirring the attainment of equilibrium is slow and uncertain. Compositions and densities of the vapour and liquid phases become uniform at the crit. temp. (cf. A., 1934, 246); vigorous stirring probably favours mutual dispersion of liquid and vapour near the crit. temp., so that discontinuity in d is not detectable. The postulation of liquid equimol. groups persisting at the crit. temp. and becoming mutually dispersed with vapour mols. is preferred to that of continuity of state. A. A. E.

System trimethyl phosphate–water. H. A. Pagel and F. S. Maxey (*J. Amer. Chem. Soc.*, 1941, **63**, 2499—2500).—The composition at the eutectic temp. (−77·0°) is Me_3PO_4 52% from f.p. data. W. R. A.

Distillation "constants." D. F. Kelly, D. MacCárthaig, and J. Reilly (*Nature*, 1941, **148**, 438—439).—The equation of Rosanoff *et al.* (A., 1914, ii, 800) has been combined with the concept of relative volatility, α (Walker *et al.*, "Principles of Chemical Engineering," New York, 1937), to give the equation $K = \log \alpha/(P_1 - P_2)$, where K is the const. in Rosanoff's equation, and P_1 and P_2 are the v.p. of the pure components. The equation of Rosanoff *et al.* relating E_0 and x_0, the initial wt. and initial mol. fraction of a component in a binary mixture, respectively, with E and x, the quantities remaining in the mixture after a finite partial distillation, is re-written in the form $\log (E/E_0) = [\alpha/(\alpha - 1)][\log (x_0/x) + \log \{(1 - x)/(1 - x_0)\}]$. L. S. T.

System $2CaO,SiO_2$–K_2O,CaO,SiO_2, and other phase-equilibrium studies involving potash. W. C. Taylor (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 311—323).—A study of the system $2CaO,SiO_2$–K_2O,CaO,SiO_2 indicates the probable existence of an intermediate compound $K_2O,23CaO,12SiO_2$ (**I**). The optical properties and the interplanar spacings of the X-ray diffraction pattern of (**I**) have been determined. (**I**) exists in a region of the K_2O–CaO–Al_2O_3–SiO_2–Fe_2O_3 system in which Portland cement compositions fall. Studies on $3CaO,SiO_2$–K_2O,Al_2O_3 and $2CaO,SiO_2$–K_2O,Al_2O_3 mixtures show that K_2O,Al_2O_3 does not exist in that region of the K_2O–CaO–Al_2O_3–SiO_2 system which is directly concerned with Portland cement. Evidence for the formation of (**I**) in commercial Portland cement clinker is offered, although it has not been identified microscopically, possibly on account of minor acid constituents, *e.g.*, SO_3, combining with most of the K_2O present. C. R. H.

Heat of formation of oleums from sulphur trioxide and water.—See B., 1941, I, 540.

[Heat of] formation of semiacetals. K. L. Wolf and K. Merkel (*Z. physikal. Chem.*, 1940, **A**, **187**, 61—65).—With the use of the calorimeter previously described (A., 1937, I, 330) the heat of formation of a semiacetal from Pr^{a}OH and EtCHO has been determined; the total effect comprises a negative heat of mixing and a positive heat of chemical reaction. The vals. are: $\Delta U_{223} = 1·30$ kg.-cal. per mol. of aldehyde for mixing, and $-8·2\pm0·1$ kg.-cal. per mol. for the reaction. The reaction rate was also followed by thermal measurements, with results that agree with those obtained earlier by optical means. F. L. U.

Heats of isomerisation of the five hexanes. E. J. R. Prosen and F. D. Rossini (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 289—310).—The heats of isomerisation of n-C_6H_{14}, γ- and β-methylpentane, $\beta\gamma$- and $\beta\beta$-dimethylbutane in the liquid state at 298° K. and in the gaseous state at 0°, 298°, 600°, and 1000° K. have been calc. from data for the heats of combustion in the liquid state. At 0° K. the order of increasing stability is that given. C. R. H.

Vapour pressure studies. H. Chlorobenzene–α-nitropropane. J. R. Lacher, W. B. Buck, and W. H. Parry (*J. Amer. Chem. Soc.*, 1941, **63**, 2422—2425).—Excess free energy of mixing for PhCl and $PrNO_2$ has been measured at 75° and 120°. The heats of mixing of the pairs PhCl–$PrNO_2$, $(CH_2Br)_2$–$PrNO_2$, and PhCl–$(CH_2Br)_2$ have been measured. The excess entropy of mixing varies approx. linearly with the vol. change for a considerable variety of liquid mixtures. W. R. A.

VII.—ELECTROCHEMISTRY.

Effect of the chemical durability of glass on the asymmetry potential and reversibility of the glass electrode. E. H. Hamilton and D. Hubbard (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 27—32).—The departures from the linear relationship between the voltage and p_H occurring when a glass electrode is in contact with solutions of p_H <9 are ∝ the extent of attack on the glass as measured interferometrically. Such departures are increased after the electrode has been immersed in conc. alkali solution. The inner surface of a glass bulb adsorbs dye (Victoria-blue B) to a much greater extent than the outer surface, so it is suggested that the difference in the adsorptive capacities of the surfaces for ions may be the cause of the glass electrode asymmetry potential. J. W. S.

Decomposition potentials of cobalt, nickel, and copper from chloride and bromide solutions.—See B., 1941, I, 556.

Polarographic wave heights in mixtures of benzylideneacetone and acetophenone. S. Wawzonek and H. A. Laitinen (*J. Amer. Chem. Soc.*, 1941, **63**, 2341—2343).—The polarographic determination of COPhMe (**I**) in the presence of CHPh:CH·COMe (**II**) in 50% Pr$^\beta$OH containing (i) 0·2N-NMe_4·OH at 25°, (ii) 0·1N-NH_4Cl at 25°, (iii) 0·1N-LiCl at 25°, and (iv) 0·001M-NMe_4·OH and 0·1N-NMe_4Br at 28°, has been investigated. (**II**) has no effect on the total diffusion current of (**I**) but affects the shape of the wave of (**I**). In (i) (cf. A., 1938, II, 282) and (iv) (**I**) yields two waves which are attributed to the direct reduction of (**I**) to $(CPhMe·OH)_2$ and CHPhMe·OH, whilst in (ii) and (iii) only one wave is observed. Possible influences of (**II**) on (**I**) are briefly discussed. W. R. A.

VIII.—REACTIONS.

Law governing the genesis and development of chemical reactions. N. S. Akulov (*J. Physics U.S.S.R.*, 1940, **3**, 165—174).—A universal relation between the time required for the spontaneous initiation of a reaction in isothermal conditions, the induction period, and the progress of the ensuing reaction with time, is developed. L. J. J.

After-burning of carbon monoxide: spectroscopic evidence for abnormal dissociation. A. G. Gaydon (*Nature*, 1941, **148**, 284).—A correction (cf. A., 1941, I, 472). L. S. T.

Speed of oxidation of nitric oxide in mixtures of oxygen and nitrogen.—See B., 1941, I, 540.

Effect of negative groups on reactivity. M. G. Evans and M. Polanyi (*Nature*, 1941, **148**, 436—437).—The acceleration caused by the presence of negative groups (X_1, X_2...) in reactions of the type $Na + XRX_1 = NaX + RX_1$ is discussed in terms of resonance. The accelerating influence of a negative substituent on the reactivity of a mol. parallels the contribution of the substituent to the electron affinity of the latter. L. S. T.

Isotopic exchange between carbon tetrabromide and bromine. J. M. Hodges and A. S. Miceli (*J. Chem. Physics*, 1941, **9**, 725).—The rate of exchange of radioactive Br between Br_2 and CBr_4 has been measured for the gas phase at 170—200° and for the liquid phase at 107—160°. The reaction appears

to be homogeneous and its velocity $\propto [CBr_4] \times [Br_2]^{0.5}$. This indicates an exchange between CBr_4 mols. and Br atoms, and the energy of activation of this reaction is zero in the gas and ~3 kg.-cal. per g.-mol. in the liquid. No parallelism between the intensity of the radioactivity of the Br_2 and the sp. reaction rate is detectable and no reaction occurs at room temp., indicating that the reaction is thermal and not initiated by the energy of nuclear decomp. The theoretical rates of reaction between CBr_4 and Br on the basis of the collision theory are 10^4—10^5 times the observed rates. J. W. S.

Rates of ammonolysis of α-halogeno-acids and α-halogeno-acylpeptides. A. F. Chadwick and E. Pacsu (*J. Amer. Chem. Soc.*, 1941, **63**, 2427—2431).—Interaction of $CHRHal{\cdot}CO_2H$ or α-halogenoacylpeptides with an excess of aq. NH_3 is bimol., the first-order reaction consts. being $\propto$ the partial pressure of NH_3 in equilibrium with the solution. Heats and entropies of activation are calc. Yields of NH_2-product are improved by rational application of the results. R. S. C.

[Catalytic] production of benzoic acid, maleic acid, and benzaldehyde from toluene at atmospheric pressure.—See B., 1941, II, 410.

Catalyst for Kjeldahl combustion of coals.—See B., 1941, I, 524.

Precipitation of basic lead acetate. Effect of small amounts of bismuth as inhibitor.—See B., 1941, I, 541.

Iron [electro]deposition.—See B., 1941, I, 553.

Electrolytic reduction of organic compounds at alloy cathodes. II. Reduction of methyl *n*-propyl ketone to pentane at cadmium–bismuth cathodes. H. J. Read (*Trans. Electrochem. Soc.*, 1941, **80**, *Preprint* 8, 69—73; cf. A., 1936, 687).—The reduction of $COMePr^{\alpha}$ to $n\text{-}C_5H_{12}$ has been studied at Cd–Bi cathodes containing 0—100% of Cd. Pure Bi and pure Cd give yields of 11·8% and 72·3%, respectively, whilst alloys containing 10—98% of Cd give yields of 40—55%. The relative constancy of the yield over a wide range of [Cd] is attributable to the two-phase structure of the alloys. J. W. S.

Photosynthesis of brown cells in the interaction of chlorophyll and carotenoids. C. Montfort (*Z. physikal. Chem.*, 1940, **A, 186**, 57—93).—Photochemical problems arising from modern views of assimilation are discussed. The importance of the part played by the yellow colouring matter of plants in the assimilation process is emphasised. An analysis of the colouring matter present in yellowish-brown diatoms and in brown algæ has been carried out by the chromatographic method in order to discover the fraction of the total energy absorbed by the yellow colouring matter. The extent of photosynthesis in plants of which the plastids contain only chlorophyll *a* and carotenoids has been examined for red and blue light of the same energy. It is shown that brown cells, in marked contrast to green cells, use blue light much more extensively than was formerly supposed. The deviations from the quantum law for blue light in the case of pure chlorophyll absorption are so great that it is necessary to assume a co-operative absorption by chlorophyll and carotenoids. Certain carotenoids, especially fucoxanthin, which absorbs in the green and greenish-blue, are to be regarded as assimilation pigments. A. J. M.

Action of light on wool and related fibres.—See B., 1941, II, 421.

IX.—METHODS OF PREPARATION.

Separation of a mixture of ^{84}Kr and ^{86}Kr from normal krypton in a separation tube. K. Clusius and G. Dickel (*Naturwiss.*, 1940, **28**, 711).—Two methods are available for the separation of a complex mixture of isotopes. A binary mixture can be prepared from the original mixture, from which the individuals can be isolated, or the middle components are enriched by removal of the lighter and heavier ones. The first of these methods has been carried out with Kr using a separation tube 27 m. long. A mixture of ^{84}Kr 22% and ^{86}Kr 78% was obtained. The composition of the mixture was determined both by the mass spectrograph and by weighing. A. J. M.

Behaviour of calcium sulphate at high temperatures. E. S. Newman (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 191—196).—Thermal analysis, microscopic, and *X*-ray methods indicate that the $\beta \rightarrow \alpha$ transition of $CaSO_4$ occurs at ~1214° and the conclusion that the α form is unstable is confirmed. A eutectic mixture of α-$CaSO_4$ and CaO with m.p. ~1365° appears to exist. The existence of basic Ca sulphates could not be confirmed. J. W. S.

Production of concentrated carbon isotope 13 by thermal diffusion. A. O. Nier and J. Bardeen (*J. Chem. Physics*, 1941, **9**, 690—692).—A thermal diffusion column 74 ft. long and divided into three sections, with the hot walls at 367—385° and the cold walls at ~27°, permits removal of 0·308 g. of CH_4 every 48 hr. in which the $^{13}C : {}^{12}C$ ratio is increased 11·5 times. Expenditure of 156 kw.-hr. of energy results in transport of 0·0135 g. of ^{13}C per 24 hr. The output is in good agreement with the theoretical val. J. W. S.

Exchange reaction between gaseous and combined nitrogen. T. H. Norris, S. Ruben, and M. D. Kamen (*J. Chem. Physics*, 1941, **9**, 726).—Contrary to the observations of Nishina and others (A., 1941, I, 420), after purification by repeated passing overheated CuO $<0{\cdot}01\%$ of radioactive $^{13}N_2$ exchanges with NO_2' or NO_3' when the gas (50 c.c.) is shaken with 0·1N- or N-$NaNO_2$ or $NaNO_3$ (10 c.c.) during 10 min. J. W. S.

New copper salts in therapeutics.—See A., 1941, III, 1054.

X.—ANALYSIS.

Gravimetric determination of bromide in organic material.—See A., 1942, III, 76.

Determination of small amounts of tellurium in copper.—See B., 1941, I, 554.

Colour analysis and colorimetry. I. Determination of nitrate. G. V. L. N. Murty (*Proc. Indian Acad. Sci.*, 1941, **A, 14**, 43—47).—Colours developed in the colorimetric determination of NO_3' by $OH{\cdot}C_6H_4{\cdot}SO_3H$ (I) and α-$OH{\cdot}C_{10}H_6{\cdot}SO_3H$ (II) have been analysed by the Keuffel and Esser colour analyser. (I) and (II) are efficient in different but sp. concn. ranges. W. R. A.

Determination of phosphorus and sulphur in coke.—See B., 1941, I, 525.

Determination of zinc in magnesium alloys.—See B., 1941, I, 557.

Quantitative spectrochemical method for zinc die-casting analysis.—See B., 1941, I, 555.

Determination of lead in biological material. Polarographic method.—See A., 1941, III, 1087.

Analysis of dental amalgams containing mercury, silver, gold, tin, copper, and zinc.—See B., 1941, I, 556.

Ferric thiocyanate reaction. C. A. Peters, and C. L. French (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 604—607; cf. A., 1939, I, 578).—Optimum conditions for the development of the red colour have been determined. The optimum acidity is 0·01N.; other concns. decrease the colour intensity. With HCl, an increase in [CNS′] offsets the bleaching effect of high [HCl], and at high [CNS′] less acid is needed to develop the same colour intensity. The increase in colour with an increase in [CNS′] is linear with no indication of a max. A variation in [$Fe^{\cdot\cdot\cdot}$], over a limited range, does not change the amount of acid necessary for max. colour intensity. The min. amounts of anions which reduce the intensity of colour are in the order P_2O_7'''', HPO_4'', PO_4''', H_2PO_4', SO_4'', Cl', and NO_3'; salt interference commences when the molar [NaCl] is 260,000 times that of the [$Fe^{\cdot\cdot\cdot}$], and that of P_2O_7'''' is 0·84 times that of the [$Fe^{\cdot\cdot\cdot}$]. With NO_3', the colour is increased. Extraction of the red colour by Et_2O depends on the ratio CNS′ : $Fe^{\cdot\cdot\cdot}$, which must be high. The initial concns. of reagents required to produce a colour lasting <15 min. are 0·0000179M-$FeCl_3$ (0·1 p.p.m. $Fe^{\cdot\cdot\cdot}$), 0·2N-NaCNS, 0·01N-HCl, and 0·0004N-H_2O_2. L. S. T.

Colorimetric determination of iron with kojic acid. M. L. Moss with M. G. Mellon (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 612—614).—Spectrophotometric investigation indicates that kojic acid (I) is a suitable compound for the colorimetric determination of $Fe^{\cdot\cdot\cdot}$. The orange colour obtained is relatively stable and conforms to Beer's law over a wide range. p_H can vary between 5·5 and 7. Max. sensitivity occurs with an [$Fe^{\cdot\cdot\cdot}$] between 1 and 20 p.p.m. for a cell thickness of 1 cm. The colour is less intense than that formed with CNS′ or *o*-phenanthroline, thus permitting

determinations to be made on samples higher in Fe without dilution. Curves showing the effect of reagent concn., [Fe^{***}], p_H, and diverse ions are reproduced. Al^{***}, P_2O_7'''', citrate, C_2O_4'', and certain coloured ions must be absent. F′ causes low results, and its effect can be utilised in determining F. The method for Fe^{***} can be applied to low-Fe waters, and to ores containing as much as 50% of Fe. Vals. obtained volumetrically for the latter agree with those obtained by using (**I**). L. S. T.

Determination of metallic iron in iron oxides and slags.—See B., 1941, I, 550.

Polarographic analysis of aluminium and its alloys.—See B., 1941, I, 557.

Ceric sulphate in oxidimetric titrations. E. E. Halls (*Ind. Chem.*, 1941, **17**, 274—277).—The use of $Ce(SO_4)_2$ in volumetric determinations of Sb^{***}, As^{***}, Pb_3O_4, PbO_2, Ca^{**} and C_2O_4'', Cr^{***}, Fe^{**}, $Fe(CN)_6''''$, Mo^{V}, NO_2', Na^{*}, Hg^{*}, TeO_3'', Ti^{***}, U^{IV}, VO^{**}, N_3H, quinol, α-keto-acids, and carbohydrates is reviewed. L. S. T.

XI.—APPARATUS ETC.

Optical Dewar vessel. P. G. Strelkov (*J. Physics U.S.S.R.*, 1940, **3**, 175—176).—A Dewar vessel fitted with two double parallel glass windows for observation of the contents by transmitted light is described. L. J. J.

Interference spectroscopy. I. K. W. Meissner (*J. Opt. Soc. Amer.*, 1941, **31**, 405—427).—The Fabry–Perot interferometer is described, and its application to the resolution and measurement of hyperfine spectral structure discussed. L. J. J.

Lundegårdh flame method of spectrographic analysis. V. R. Ells (*J. Opt. Soc. Amer.*, 1941, **31**, 534—542).—In the method described, a solution of the ashed substance (*e.g.*, plant material or soil) in dil. HCl is atomised in an air stream and mixed with C_2H_2 before passing to a burner. The spectral region 3250—4600 A. is photographed and the line intensities of the elements are compared with those given by standard solutions or with the C_2H_2 flame background. The sensitivity is $<10^{-4}$M. for the alkali and alkaline-earth metals and a no. of other elements, and most of the detectable elements can be determined with an accuracy of $\pm<5\%$ of the amount present. L. J. J.

High-frequency spark discharge for local micro-analysis. W. M. Murray, jun., B. Gettys, and S. E. Q. Ashley (*J. Opt. Soc. Amer.*, 1941, **31**, 433—438).—In the method described, a highly localised high-frequency spark is caused to traverse systematically the surface of a metallic specimen, and the local composition of the surface is correlated with the spectral character of the light emitted. L. J. J.

Construction and use of *X*-ray powder cameras. A. J. Bradley, H. Lipson, and N. J. Petch (*J. Sci. Instr.*, 1941, **18**, 216—219).—The 19-cm. camera described consists of a circular base (with a light-tight cover) to which are attached two channelled blocks, one carrying the collimator system and the other acting as a trap to catch the undeflected beam. A perforated flanged plate mounted on the blocks forms with the base a cylinder on the surface of which the film is mounted and carries the bearing for the rotating specimen holder. In the 35-cm. camera, embodying the same principles, evacuation is provided for. Moreover, since the films would be unduly long, intermediate knife-edges are used and four pieces of film are inserted. A. A. E.

Achromatic reflexion microscope for use with visible or ultra-violet light. B. K. Johnson (*Proc. Physical Soc.*, 1941, **53**, 714—719; cf. A., 1940, I, 132).—The instrument described is developed from a design previously reported (cf. A., 1935, 188). An aluminised parabolic mirror and a LiF–SiO_2 objective are employed, and the calc. aberration vals. are given. N. M. B.

Physical photometer. R. P. Teele (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 217—228).—The photometer described consists of three elements: (i) a luminosity filter which has a relative spectral transmission similar to that of the average human eye, (ii) a thermopile, and (iii) a sensitive potentiometer. The stability of the receiver is such that the response to a given density of luminous flux does not vary >0·2% from the average during 6 months. The application of the photometer to the measurement the candlepower of lamps is discussed. C. R. H.

Correcting spherical error of electron lenses, especially of those employed with electron microscopes. R. Kompfner (*Phil. Mag.*, 1941, [vii], **32**, 410—416).—The error is avoided by introduction of a spherical double grid, supplied with high-frequency a.c., which concentrates an intermittent electron beam on the object and causes the velocity of the electrons to increase with their distance from the lens axis. The method, which is discussed theoretically, also permits correction for chromatism of the irradiating electrons. A. J. E. W.

Stereo-supermicroscopy with the universal electron microscope. M. von Ardenne (*Naturwiss.*, 1940, **28**, 248—252).—The electron microscope is particularly well suited for stereoscopic work. The various methods by which the stereoscopic images can be formed are described, and examples of the use of the method are given. A. J. M.

Multiple electrode system for potentiometric titration studies. H. A. Frediani and W. E. Warren (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 646—647).—A flexible multi-electrode system, consisting of one reference electrode (AgCl or Hg_2Cl_2) and 18 indicator electrodes, is used to determine the optimum system for any given determination. Electrodes, electrode support, and electrode assembly are described. L. S. T.

Effect of temperature on the resistance of selenium rectifiers. P. V. Scharavski (*J. Physics U.S.S.R.*, 1940, **3**, 379—384).—The variation of the resistance of Se rectifiers over the range 65° to −183° has been determined. The effect in the direction in which the current will flow is $\ll$ that for Cu_2O rectifiers. The temp. coeff. of resistance of the rectifying Se layer is negative at low potentials and positive at high potentials (>20 v.). The transition temp. between positive and negative coeffs. rises with increasing potential. Modern theories of the action of rectifying layers are discussed, and it is shown that they give a qual. explanation of the observed temp. coeff. of resistance. A. J. M.

Completely automatic emanation apparatus. K. E. Zimens (*Z. physikal. Chem.*, 1940, **A, 186**, 94—104).—Apparatus is described which produces and records emanation–temp. curves. Curves are given for mixed crystals of $BaCO_3$–$CaCO_3$, amorphous silicic acid, and magnetite. The process can record rapid changes in emission of emanation, and has many advantages over the electrostatic methods of determining ionisation. A. J. M.

Proton accelerator for irradiation of living matter.—See A., 1941, III, 1086.

Silvering of glass: effect of organic acids on formation of a silver mirror.—See B., 1941, I, 546.

Apparatus for Kjeldahl determination of nitrogen in coal.—See B., 1941, I, 524.

Apparatus and methods for precise fractional distillation analysis. Adiabatic fractionating column and precision-spaced wire packing for temperature range −190° to 300°. W. J. Podbielniak (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 639—645).—The column described and illustrated is satisfactory over the range −190° to 300° with extended use of vac. jacketing around the column, flask, reflux, and all connexions. New vac.-jacketed standard-taper ground joints withstand liquid air temp. and temp. of 300°. Flexible glass bellows are used as expansion joints. A new form of precision-spaced wire packing has also been developed. Performance data are recorded for *n*-C_7H_{16} and methylcyclohexane, and the application of the column and packing to low- and high-temp. fractionation is described. L. S. T.

Laboratory condenser. M. T. Bush (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 592).—The double spiral condenser illustrated is made of Pyrex glass, and can be used with H_2O, ice, or solid CO_2 for downward distillation and refluxing. L. S. T.

Potentiometric titration stand assembly. L. Lykken and F. B. Rolfson (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 653—655).—The apparatus described and illustrated is suitable for most routine electrometric titrations. Adaptations to semi-micro-determinations is also described. L. S. T.

Magnetic stirrer for use in the cup type of moisture-transfusion apparatus. H. K. Burr and H. J. Stamm (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 655). L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

FEBRUARY, 1942.

I.—SUB-ATOMICS.

Cosmic abundance of light elements. A. Unsöld (*Physikal. Z.*, 1940, **41**, 549—552).—The relation between liberation of nuclear energy and the cosmic abundance of elements (cf. Bethe, A., 1939, I, 237; von Weizsäcker, A., 1938, I, 490) is discussed, with special reference to the bifurcation of spectral series in Wolf–Rayet and cool stars. Application of a new method of analysis to τ Scorpii (*BO*-type) shows high abundance of H and He and a C : N ratio in accord with Bethe's theory; data are also given for O, Ne, Mg, Al, Si, and S. A. J. E. W.

Effect of density on the displacement of high series-lines of the alkali metals by foreign gases. C. Füchtbauer and G. Häusler (*Physikal. Z.*, 1940, **41**, 555—559).—A detailed account of work already reported (A., 1940, I, 50). The dielectric const. component of the displacement is $\propto$ the relative d of the added gas. A. J. E. W.

Interference spectroscopy.—See A., 1942, I, 27.

High-frequency spark discharge for local micro-analysis.—See A., 1942, I, 27.

Lundegårdh flame method of spectrographic analysis.—See A., 1942, I, 27.

***L* Radiation from sulphur.** D. H. Tomboulian and W. M. Cady (*Physical Rev.*, 1941, [ii], **60**, 551—553; cf. Skinner, A., 1941, I, 21).—A spectrophotometric study, and deduction of the intensity contour of the *L* emission band from a S target, are reported. The main features are a strong peak at 149 e.v., less pronounced structures at ~158 e.v., and a broad peak or "tail" around 136 e.v., in agreement with available data. In contrast to the corresponding bands of the metals of the second row of the periodic table, the intensity drop on the high-energy side of the band is gradual; hence the L_{II} and L_{III} edges have not been separated. An interpretation of results is suggested. No trace of the L_I–L_{III} transition was found. N. M. B.

Behaviour of foreign metal particles in the composite photo-cathode. S. Asao (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 448—486; *Rev. Phys. Chem. Japan*, 1941, **15**, 134).—Experiments on the condensation of Ag atoms on various activated Cs–Cs_2O cathodes are described, and from the results the construction of the composite cathode, the selective emission humps appearing in the spectral sensitivity curve, and the relation between foreign metal particles and thermionic emission are discussed. C. R. H.

Photo-electric threshold of bismuth films of measured thickness. A. H. Weber and L. J. Eisele (*Physical Rev.*, 1941, [ii], **60**, 570—573).—Work previously reported (cf. A., 1938, I, 378) is extended, with improved apparatus and method, to include measurement of average film thickness and extension of the temp. range in which the Du Bridge analysis is applied. Results show that the films are characterised by an initial val. of the threshold λ (2497 A. average) fairly independent of film thickness for the first 44 atom layers, and a shift towards higher threshold $\lambda\lambda$, occurring between 44 and 111 atom layers thickness, followed by a steady increase of threshold λ with film thickness >~111 atom layers. N. M. B.

Electrical conductance and photo-electric emission of thin bismuth films. A. H. Weber and D. F. O'Brien (*Physical Rev.*, [ii], **60**, 574—578; cf. preceding abstract).—Simultaneous measurements of conductance and emission as functions of average film thickness are reported for films evaporated at 1·11 atom layers per min. in vac., and condensed on Pyrex continuously at liquid-air temp., discontinuously at room temp., and continuously at room temp. For all films the conductance and emission increase abruptly and nearly together at some film thickness dependent on condensation temp. and ageing of the film. The agglomeration of mobile condensed atoms satisfactorily explains the results, but the process is complex and is probably influenced by the condition of the backing surface. No photo-conductive effect was observed for films, aged or unaged, deposited at room or liquid-air temp. N. M. B.

Positive and negative thermionic emission from molybdenum. R. W. Wright (*Physical Rev.*, 1941, [ii], **60**, 465—467).—From thermionic emission measurements the val. found for the electron work function is 4·20 v. and for the positive ion work function 8·6 v. The positive ion const. term is in good agreement with Smith's equation (cf. A., 1930, 514). N. M. B.

Electron theory of thermo-electric effects. W. V. Houston (*J. Appl. Physics*, 1941, **12**, 519—529).—A qual. interpretation of the Peltier and Thomson effects and of the thermo-electric force is derived from consideration of the change in the statistical distribution of electrons in a metal under the influence of electric field and temp. gradient. The Kelvin equations are deduced. O. D. S.

Determination of the atomic field of bromine from electron scattering. W. E. Frye (*Physical Rev.*, 1941, [ii], **60**, 586—588).—The experimental electron scattering curves are analysed by Voss' method to determine the phase shifts as functions of the energy. The at. field of Br is then calc. from the phase shifts by an approx. method due to Hoyte and Frye (cf., A., 1941, I, 146). N. M. B.

Magnetic susceptibility of two-dimensional free electron gas. B. N. Singh (*Indian J. Physics*, 1941, **15**, 103—111).—The para- and dia-magnetic susceptibilities of a two-dimensional free electron gas have been calc. and the results compared with the susceptibilities of a three-dimensional assembly. W. R. A.

Electrical resistance of liquid sodium. A. Harasima (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 183—188; *Rev. Phys. Chem. Japan*, 1941, **15**, 133).—The abs. val. of the electrical resistance of liquid Na has been calc. on the basis of the electron theory of metallic conduction. Agreement with experiment is good. The temp. coeff. of resistance has been calc. C. R. H.

Deviations from Ohm's law in semi-conductors. W. Schottky [with (Frl.) A. Schmidt] (*Physikal. Z.*, 1940, **41**, 570—573).—A review and discussion of previous work on conduction at a metal/semi-conductor interface (cf. A., 1939, I, 60, 544; 1940, I, 147), supplemented by differential resistance and reciprocal capacity data for Se barrier-layer cells with cathodically sputtered Au electrodes. A. J. E. W.

How are conductivity electrons in a metal stratified under the action of gravity? F. Wolf (*Physikal Z.*, 1940, **41**, 573—575).—Theory is developed which shows that "sedimentation" by gravity of conductivity electrons in an infinite horizontal plate should produce a linear potential gradient of $\sim 0{\cdot}56 \times 10^{-10}$ v. per cm., due to enrichment and impoverishment of electrons in layers ~1 A. thick at the lower and upper surfaces, respectively. Approx. the same gradient is expected in a vertical rod. A. J. E. W.

Measurement of energy distribution of secondary electrons. R. Kollath (*Physikal Z.*, 1940, **41**, 576—579).—In the apparatus described a longitudinal magnetic field (H) brings all

secondary electrons of given energy (E) to a focus at a distance from the source which depends on E and H. By fixing the position of a suitable collector and varying H, an electron-current–H curve is obtained which expresses the E distribution of the electrons. Typical curves, showing the effects of various heat-treatments, are given for Ta, Mo, and Be; the E distribution max. occurs in each case at 1—2 e.v. A. J. E. W.

Mobility of protons in an electric field in the α-phase of the system palladium–hydrogen. C. Wagner and G. Heller (*Z. physikal. Chem.*, 1940, **B**, **46**, 242—249).—The transport no. of H^+ in Pd under 1 atm. H_2 has been measured at 182° and 240° by determining the pressure difference produced between the two ends of a Pd wire through which a d.c. of 0·2 amp. was passed for periods from 20 to 55 days. Vals. of $1{\cdot}46 \times 10^{-4}$ and $2{\cdot}80 \times 10^{-4}$ sq. cm. per v. per sec. for the mobility of the proton at 182° and 240° respectively are calc. These vals. are from 0·4 to 0·55 of those calc. from the known velocity of diffusion of H_2 through Pd. The deviation is due to interaction between ions of opposite signs. O. D. S.

Polarity of ions in the positive striations of a glow discharge in nitrogen and oxygen. E. Wehnelt and H. Lämmerhirt (*Z. tech. Physik*, 1940, **21**, 88—92).—The polarity of the ions in the light and dark striations in the positive column of a glow discharge in N_2 or O_2 has been investigated by means of a probe electrode. It is concluded that both positive and negative ions are present in the light, whilst very few ions are present in dark, striations. O. D. S.

Radiative detachment and attachment of negative oxygen ion. T. Yamanouchi (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 569—578; *Rev. Phys. Chem. Japan*, 1941, **15**, 131).—Certain atoms can exist stably in negatively charged states, and the electron affinity is great for atoms having nearly closed outer shells. O^-, produced in the upper atm., plays an important part in producing and removing free electrons in the ionosphere. The abundance of O^- may be far inferior to that of neutral O, but the probability of ionisation of the latter is small. The detachment of O^- gives a chance of the production of the metastable ^1D and ^1S states of neutral O, which are the origin of auroral and night-sky light. The corresponding probability of the production of these states by radiative recombination of O^+ is small. C. R. H.

Excitation of crystal phosphors by corpuscular rays. F. Möglich and R. Rompe (*Physikal. Z.*, 1940, **41**, 552—555; cf. Riehl and Schön, A., 1940, I, 196).—Energy transfer from the bombarding particle occurs in the electron gas of the phosphor crystal; each particle produces a shower of excited electrons, which lose their energy by radiation. A fast electron initiates a cascade of electrons of progressively decreasing energy, but an α-ray excites many relatively slow electrons, each of which produces a shower; the mean life of an excited electron is much longer in the former case, and the possible no. of lattice collisions is much larger. Quantum yields obtained with α-rays are consequently $\gg$ those for electrons. A. J. E. W.

Temperature-dependence of the periodic deviations from the Schottky line. E. Guth and C. J. Mullin (*Physical Rev.*, 1941, [ii], **60**, 535).—A re-examination of data has eliminated disagreements previously reported (cf. A., 1941, I, 285). From observed positions of the max. and min. of the amplitudes of the deviations the calc. no. of free electrons per atom for W is $\geqslant 0{\cdot}35$, in agreement with the val. found from the magnitude of the double layer necessary to yield the observed dependence of the work function of W on its different crystal faces. N. M. B.

Calculation of activities of radioactive substances in series disintegrations. D. E. Hull (*J. Physical Chem.*, 1941, **45**, 1305—1312).—A set of 70 formulæ which permit the calculation of the activity of any member of the three naturally occurring radioactive series at any time after any arbitrary initial conditions is presented. C. R. H.

Microcalorimetric determination of the mean energy of β-rays from radium-E. I. Zlotovski (*Physical Rev.*, 1941, [ii], **60**, 483—488).—A detailed account of work previously reported (cf. A., 1939, I, 591). The precision method involves an adiabatic change of temp. of a small calorimeter, the heat capacity being measured by the change in temp. produced by several strong sources of Po of known abs. content. The average val. of the β-ray mean energy of Ra-E is 320 ± 5 ke.v. Measurements made in air gave $323{\cdot}6 \pm 3{\cdot}5$, and in N_2 $317{\cdot}6 \pm 2{\cdot}5$ ke.v. Results are compared with available data. N. M. B.

Absorption coefficient of β-rays. D. T. Tcheng and J. T. Yang (*Physical Rev.*, 1941, [ii], **60**, 616—617).—Measurements of the absorption of U-X_2 and Ra-E in Al, Cu, and celluloid absorbers confirm the view that absorption is not rigidly exponential but increases with thickness of absorber. The absorption curves are not exponential but form broken lines composed of segments of straight lines, the slope of each representing a definite val. of absorption coeff. for a certain range of absorber thickness. The variation of the coeff. with measuring conditions is discussed, and data for mass absorption coeffs. for the range 0—β-ray limit are tabulated. N. M. B.

Analysis of experimental data for β-disintegration. J. Itoh (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 531—550; *Rev. Phys. Chem. Japan*, 1941, **15**, 131).—Theoretical. Mass differences of isobaric pairs, the Sargent relation, and the possible selection rule for β-transition are discussed, and essential agreement with the Fermi theory is deduced. Only transitions between isobaric pairs belonging to the same multiplet discussed by Wigner are allowed a strict meaning, but other transitions are considered. Spin 0-to-spin 0 transition is forbidden. It is shown that the heavy particle matrix elements for a heavy β-radioactive body will be of the same order as those for light elements, provided that the change in nuclear structure is similar in both cases. C. R. H.

Scattering of slow neutrons by some elements. M. Kimura (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 391—397; *Rev. Phys. Chem. Japan*, 1941, **15**, 130).—The scattering cross-sections of slow neutrons ("C" and "D" neutrons) were measured for Hg and its compounds, Ag, and I. Hg and its compounds have a large "C"-neutron scattering cross-section as compared with the "D"-neutron cross-section. The scattering cross-sections for Ag and I are independent of neutron energy. The marked non-additivity in the scattering cross-sections between Hg, S, and HgS previously reported is in error. C. R. H.

Resonance capture of slow neutrons and emission of γ-rays. II. I. Nonaka (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 551—560; *Rev. Phys. Chem. Japan*, 1941, **15**, 130).—The γ-ray intensity emitted during neutron capture has been measured. From the γ-ray intensity curves it is shown that Cl has no distinct resonance groups, and Co and Ba have energy groups of ~10—100 and ~1000 e.v., respectively. The relative vals. of γ-ray quanta emitted per capture of a thermal neutron are 0·64, 0·74, 1·00, and 0·82 for Cl, Ag, Cd, and Hg, respectively. C. R. H.

Recent research in nuclear physics. G. Hoffmann (*Physikal. Z.*, 1940, **41**, 514—522).—A review illustrating the experimental approach to the study of nuclear forces and structure. The topics discussed include mass-spectrography, the cyclotron, U fission, the mesotron, and cosmic-ray showers. A. J. E. W.

Measurements on hard H-rays. W. Jentschke [with L. Wieninger] (*Physikal. Z.*, 1940, **41**, 524—528).—A double ionisation chamber is described with which the ionising effect and range (r) of individual protons of high energy can be measured simultaneously; the method permits unequivocal distinction of protons from accompanying α-rays. The sp. and total ionisation due to protons with $r = 6$—70 cm. (in air at 15° and 760 mm.) are determined. The hardest protons emitted from B bombarded by α-rays from Po have $r = 94$ cm. A. J. E. W.

Nuclear spectra of light elements on the photographic plate. O. Merhaut (*Physikal. Z.*, 1940, **41**, 528—532).—A photographic method, using Ilford half-tone or Agfa "K" plates, for determination of the range of protons emitted in nuclear reactions is described; the method is particularly suitable for the detection of weak proton groups. Typical data are given for protons from Al, Na, P, and B bombarded with α-rays from Po, and the reaction energies corresponding with each group are calc. A. J. E. W.

Nuclear scattering. K. C. Kar (*Indian J. Physics*, 1941, **15**, 113—122).—The formula for the intensity of proton–proton scattering (A., 1940, I, 144) agrees with the experimental val. (Heydenburg *et al.*, *ibid.*, 51). The corresponding formulæ for deuteron–deuteron and deuteron–He scattering have been derived and agree with the vals. found by Heyden-

burg and Roberts (*ibid.*, 51). The correction for the relative motion of the scattering particle is not negligible for deuteron scattering by He, but may be neglected for proton scattering by He in agreement with experiment. W. R. A.

Photo-disintegration of deuteron by radium γ-rays. M. Miwa (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 560—568; *Rev. Phys. Chem. Japan*, 1941, **15**, 131).—The mean free path of Ra γ + D neutrons in paraffin is 12·7±2·0 mm., a val. > that expected for the 2·198-Me.v. line of Ra-*C*. It is assumed, therefore, that there exists a Ra-*C* line or lines having effective energy 2·6 Me.v. and being more effective for neutron liberation than the 2·198-Me.v. line. Ra-*C* γ-rays of 2·198 Me.v. are less effective in disintegrating D than expected for a virtual ^1S level. This is in good agreement with observation on the angular distribution of Rd-Th γ + D neutrons, but is contrary to the evidence obtained with thermal neutrons. C. R. H.

Protons from deuteron bombardment of ^{13}C. R. F. Humphreys and W. W. Watson (*Physical Rev.*, 1941, [ii], **60**, 542—544; cf. Bennett *et al.*, A., 1941, I, 313).—Comparison of the proton groups emitted under deuteron bombardment by a target of C and by one enriched 25 times in ^{13}C shows the existence of an excited state of ^{14}C at 5·24±0·29 Me.v. This state is a possible source for the 5·5-Me.v. γ-rays. N. M. B.

γ-Rays excited in magnesium by Po α-particles. A. Szalay (*Naturwiss.*, 1940, **28**, 667—668).—The excitation function of the γ-rays emitted by Mg when bombarded with Po α-rays has been determined. The radiation starts with α-rays of 5·5 mm. range (1 Me.v.). The intensity remains const. up to a range of ~3 cm., and then suddenly increases. α-Particles of 1 Me.v. cannot penetrate a nucleus of at. no. 12, so this is a case of excitation without transformation. The ^{24}Mg nucleus is excited by particles of energy 1 Me.v. The sudden rise at 3 cm. range is possibly due to a transformation. A. J. M.

γ-Rays emitted by the addition of protons to phosphorus. N. Hole, J. Holtsmark, and R. Tangen (*Naturwiss.*, 1940, **28**, 668—669).—The bombardment of P with protons gives rise to γ-rays due to the reaction $^{31}P + {}^1H = {}^{32}S + h\nu$. The excitation function shows three resonances at 347, 433, and 530 kv. A. J. M.

Extension of the radioactive series, $Z = N \pm 1$. D. R. Elliott and L. D. P. King (*Physical Rev.*, 1941, [ii], **60**, 489—496; cf. A., 1941, I, 143).—The half-lives of the radioactive positron emitters ^{27}Si, ^{31}S, and ^{35}A, produced by 15-Me.v. α-particles, were 4·92±0·1, 3·18±0·04, and 1·88±0·04 sec., respectively, and that of ^{41}Sc, obtained by 8-Me.v. deuterons, was 0·87±0·03 sec. The upper limit of the energies of the positrons emitted by ^{31}S, ^{35}A, and ^{41}Sc were 3·87±0·15, 4·41±0·09, and 4·94±0·07 Me.v., respectively. The Coulomb energies of the "extra proton" of the nuclei of the $Z - N = 1$ series were calc. on the homogeneous nucleus and homogeneous core models. The variations in the Coulomb energies indicate a nucleus "shell" structure similar to that given by the Hartree nuclear model. N. M. B.

Production and isotopic assignment of long-lived radioactive sulphur. M. D. Kamen (*Physical Rev.*, 1941, [ii], **60**, 537—541).—Thick-target yields for the nuclear processes giving rise to the isotope are reported. The cross-sections calc. from yield vals. favour the assignment ^{35}S. The processes are ^{34}S (d, p) ^{35}S, ^{37}Cl (d, α) ^{35}S, and ^{38}Cl (n, p) ^{35}S, and the targets are FeS, RbCl, and CCl_4, respectively. The upper limit for negative electrons emitted by ^{35}S is found by absorption measurements in Al and Cellophane to be 120±15 ke.v. The half-life is 88±3 days. Neutron irradiation of CCl_4 is the most efficient means of producing ^{35}S for tracer work; chemical extraction and application to large-scale production are described. N. M. B.

Radioactive argon ^{37}A. P. K. Weimer, J. D. Kurbatov, and M. L. Pool (*Physical Rev.*, 1941, [ii], **60**, 469).—An activity assigned to ^{37}A (34 days) has been produced by the following reactions: $^{37}Cl + {}^2H \rightarrow {}^{37}A + 2{}^1n$, $^{37}Cl + {}^1H \rightarrow {}^{37}A + {}^1n$, $^{39}K + {}^2H \rightarrow {}^{37}A + {}^4He$, $^{40}Ca + {}^1n \rightarrow {}^{37}A + {}^4He$, $^{34}Sr + {}^4He \rightarrow {}^{37}A + {}^1n$. N. M. B.

Artificial radioactivity of ^{45}Ti. J. S. V. Allen, M. L. Pool, J. D. Kurbatov, and L. L. Quill (*Physical Rev.*, 1941, [ii], **60**, 425—429).—An activity of half-life 3·08±0·06 hr. was produced by four different types of bombardment, and evidence for the assignment to ^{45}Ti is given. The four nuclear reactions are: $^{42}Ca + {}^4He \rightarrow {}^{45}Ti + {}^1n$, $^{45}Sc + {}^1H \rightarrow {}^{45}Ti + {}^1n$, $^{45}Sc + {}^2H \rightarrow {}^{45}Ti + 2{}^1n$, $^{45}Ti + {}^1n \rightarrow {}^{45}Ti + 2{}^1n$. A reaction ^{46}Ti (γ, n) ^{45}Ti is improbable. Analysis of cloud-chamber photographs indicates 1·2 Me.v. for the max. positron energy. N. M. B.

Energy and multipole order of nuclear γ-rays. A. C. Helmholz (*Physical Rev.*, 1941, [ii], **60**, 415—425).—Energies of some nuclear γ-rays emitted in deuteron-induced radioactivities were measured with a magnetic β-ray spectrograph with photographic film as detector. Independent measurements of the multipole order were obtained where possible from the internal conversion coeff., the K/L conversion ratio, and the lifetime of the γ-ray transition. The nuclei and γ-ray energies (in ke.v.) are: ^{44}Sc 268±5, ^{69}Zn 439±5, ^{67}Zn 92·5±1, 180±2, and 297±2, ^{79} or ^{81}Sc 99±1, ^{83}Kr 46±1 and 29±1, ^{87}Sr 386±5, element 43 97±1, ^{107} or ^{109}Ag 92·5±1, ^{127}Te 86±1·5, ^{129}Te 102±1·5, ^{131}Te 177±3. Transition half-life, multipole order and type of radiation, and probable nuclear spins are given as far as ascertained. N. M. B.

Radiations from radioactive cobalt. A. S. Jensen (*Physical Rev.*, 1941, [ii], **60**, 430—434; cf. Perrier, A., 1938, I, 111).—A special cloud chamber is described for measuring the energies of the radiations from ^{55}Co (270 days) and ^{56}Co (72 days) formed by deuteron bombardment of Fe. A positron spectrum of max. energy 1·36±0·10 Me.v. was observed on the histogram. The Konopinski–Uhlenbeck plot of the data suggests also another spectrum with an energy end-point near 0·5 Me.v. One internally converted γ-ray near 0·1 Me.v. was observed in the cloud chamber and resolved into two lines at 117 and 130 ke.v., respectively. The histogram from ^{58}Co produced by bombarding Mn with α-particles assigns the higher-energy positron spectrum to ^{58}Co. N. M. B.

Radiations from radioactive ^{65}Zn. Y. Watase, J. Itoh, and E. Takeda (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 90—105; *Rev. Phys. Chem. Japan*, 1941, **15**, 129).—^{65}Zn decays by K-electron capture as well as by positron emission to ^{65}Cu, the probability of the former being 80 times that of the latter. The max. energy of positrons was 0·47 Me.v. Intense γ-rays with energy 1·0, 0·65, and 0·45 Me.v. accompanied K-electron capture. No primary electrons of continuous spectrum nor internal conversion electrons were found. By coincidence measurements of counters positron–γ, K-X-ray–γ, and γ–γ coincidences were observed. (Cf. following abstract.) C. R. H.

Radioactivity of ^{65}Zn. J. Itoh and Y. Watase (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 784—785; *Rev. Phys. Chem. Japan*, 1941, **15**, 130).—The relative decay of positron, X-ray, and γ-ray from radioactive ^{65}Zn over several months showed that the decay const. was the same in each case. (Cf. preceding abstract.) C. R. H.

Radioactive bromine isotopes from uranium fission. A. Moussa and L. Goldstein (*Physical Rev.*, 1941, [ii], **60**, 534—535).—U fission by thermal and fast (Rn + Be) neutrons gave Br (35 min.), attributed to ^{84}Br, and Br (2·3 hr.) coinciding with a period found by Langsdorf (cf. A., 1940, I, 141) and attributed to ^{83}Br. A 3·8-hr. period reported by Hahn (cf. A., 1939, I, 443) is not confirmed. There is evidence that the 35-min. and 2·3-hr. activities are direct fission products. ^{84}Br (35 min.) may be identical with the product reported by Snell (cf. A., 1938, I, 8) which could have been formed in Snell's experiments by the reaction ^{87}Rb (n, α) ^{84}Br. Production cross-sections are tabulated. N. M. B.

Radiations from the disintegration of ^{82}Br. A. Roberts, J. R. Downing, and M. Deutsch (*Physical Rev.*, 1941, [ii], **60**, 544—550).—Radiations from the 36-hr. slow-neutron-induced ^{82}Br were studied by coincidence, absorption, and spectrometer measurements. The β-ray spectrum is simple (this is confirmed by independent coincidence measurements by the β-ray spectrometer), and its end-point is at 0·465±0·01 Me.v. Each β-ray is accompanied by three cascade γ-rays of energies 0·547±0·01, 0·787±0·015, and 1·35±0·03 Me.v. Neither orbital electron capture to ^{82}Se nor internal conversion of the γ-rays is observed. The excited states of ^{82}Kr obtained in this disintegration are discussed. N. M. B.

Bromine and iodine isotopes of short life from the fission of uranium. F. Strassmann and O. Hahn (*Naturwiss.*, 1940, **28**, 817—820).—The half-life periods of two Br isotopes obtained from the fission of U are 30±5 min. and 140±10 min., respectively. Two new short-lived Br isotopes of half-life

period 50 ± 10 sec. and $3{\cdot}0\pm0{\cdot}5$ min., and two new I isotopes of half-life period 30 ± 6 sec. and $1{\cdot}8\pm0{\cdot}4$ min., are also produced in the same process. Y and La isotopes must be produced as primary fission partners of the Br and I isotopes. A. J. M.

Half-life of iodine (128). D. E. Hull and H. Seelig (*Physical Rev.*, 1941, [ii], **60**, 553—555).—High-precision measurements with a Geiger–Müller counter and amplifying circuit give the val. $24{\cdot}99\pm0{\cdot}02$ min. N. M. B.

Radioactive isotopes of barium from cæsium. J. M. Cork and G. P. Smith (*Physical Rev.*, 1941, [ii], **60**, 480—482).—Bombardment of Cs with 9·5-Me.v. deuterons gives Ba activities (40·0 and 340 hr.). The 40-hr. product consists of a partly converted 276-ke.v. γ-ray; the 340-hr. product is associated with K-electron capture in ^{133}Ba and consists solely of a 17-ke.v. γ-ray and the K X-radiation of Cs of energy ~30 ke.v. The 40-hr. activity is probably due also to a highly excited state of ^{133}Ba. The probability of total conversion for the 40-hr. γ-ray is ~71%, and the ratio of the K and L components is 3·18, indicating a change in angular momentum of 4 units. N. M. B.

Transmutation of mercury by fast neutrons. R. Sherr, K. T. Bainbridge, and H. H. Anderson (*Physical Rev.*, 1941, [ii], **60**, 473—479).—Products formed by the (n, p) reactions by fast (Li + D) neutrons were ^{198}Au (65 hr.), ^{199}Au (78 hr.), and a new unassigned electron emitter (48 min.). Products attributed to (n, α) reactions in Hg were ^{199}Pt (29 min.), ^{197}Pt (19 hr.), and a new activity (80 min.). This last was also observed in deuteron and fast-neutron bombardment of Pt but not in slow-neutron irradiation of Pt. Hg activities (43 min., 25 hr., and 50 days) were observed in the fast-neutron irradiation of Hg; the 43-min. and 25-hr. activities were also formed by bombarding Pt with α-particles. Assignments are discussed. N. M. B.

Disintegration scheme of the yttrium activity of 100-day half-period. J. R. Downing, M. Deutsch, and A. Roberts (*Physical Rev.*, 1941, [ii], **60**, 470; cf. Pecher, A., 1941, I, 143).—In a study of the γ-rays by the magnetic-lens spectrometer, photo-electrons from Pb and Sn radiators and Compton recoil electrons from a thick Al radiator were investigated. Observed γ-ray energies of $0{\cdot}908\pm0{\cdot}02$ and $1{\cdot}89\pm0{\cdot}05$ Me.v. accord with available data. A disintegration scheme based on the observation of coincidences between γ-rays recorded in Geiger–Müller counters indicates that two γ-rays follow each other in cascade. Coincidences between the γ-rays and Sr X-rays following each electron capture process in Y together with other data (cf. Richardson, A., 1941, I, 442) support the scheme. N. M. B.

Radiochemistry of europium. K. Fajans and A. F. Voigt (*Physical Rev.*, 1941, [ii], **60**, 533—534; cf. A., 1939, I, 591).—Carefully purified Eu gave, by slow-neutron bombardment, an activity which had a flat max. in the activity curve for the first 6 months, but afterwards gave a pure decay with half-life ~5—8 years as measured for 8 months. Purified Eu_2O_3 bombarded with deuterons showed only traces of any period < the 9-hr.; their initial intensity was >5% of the 9-hr. activity, and thus the 12- and 105-min. activities previously reported from less pure samples are not confirmed. Prolonged deuteron bombardment of the purified Eu_2O_3 gave a period of the same order (5—8 years) as the neutron-induced long period, and also an unidentified 155—170-day activity (not Eu) which may be Sm or Gd. The most probable assignment of the 5—8-year product is ^{154}Eu. N. M. B.

Cascade showers in heavy elements. H. C. Corben (*Physical Rev.*, 1941, [ii], **60**, 435—439).—Mathematical. The one-dimensional equations of the cascade theory of showers are solved, account being taken of the variation with energy of the cross-section for pair production. This feature is important in the case of showers and bursts in elements of high at. no. Numerical deductions for Pb are discussed. N. M. B.

Temperature effect with cosmic rays. W. Kolhörster (*Physikal. Z.*, 1940, **41**, 532—537).—Double coincidence counter data obtained during 1·5 years, with unfiltered and coupled rays and with rays filtered through 10 cm. of Fe or 8—10 cm. of Pb, show a temp. effect which is negative for the annual period but positive (and probably composite) for the diurnal period. The pressure effect is negative throughout, but greater in the diurnal period. A. J. E. W.

Absorption curves for ultra-radiation in lead under 1000 metres water-equivalent. J. Barnóthy and M. Forró (*Physikal. Z.*, 1940, **41**, 538—540).—Cosmic-ray absorption curves, each showing sharp max. and min., are given for >92·5 cm. of Pb at a depth (d m. H_2O-equiv.) of 957, and for >82 cm. of Pb under 70 cm. of wood at $d = 941$. Only one component of cosmic radiation, consisting of neutrons or neutrinos, penetrates to $d > 500$; this component produces secondary rays (probably mesons) of range 10—25 cm. (in Pb) in the soil, brick, and Pb near the counters. Rays (probably protons) of range 40 cm. in Pb are produced in the wood. A. J. E. W.

Are there neutral mesotrons in cosmic radiation? Y. Nishina and K. Birus (*Naturwiss.*, 1940, **28**, 779—780).—If neutral mesotrons exist it would be expected that charged and uncharged mesotrons could be mutually converted into one another according to the scheme $P + M^- \rightleftharpoons N + M$, $N + M^+ \rightleftharpoons P + M$, where P = proton, N = neutron, M = mesotron. Experimental work is reviewed, but it does not lead to evidence for the existence of such reactions. A. J. M.

Use of photographic plates as an aid to cosmic-ray investigations. D. M. Bose (*Indian J. Physics*, 1941, **15**, 145—160).—A lecture. W. R. A.

Cosmic radiation. E. Wollan (*Bol. Soc. Quim. Peru*, 1941, **7**, 159—164).—A historical survey from which it is concluded that the primary cosmic radiation consisting of protons gives rise to the secondary radiation of mesotrons. The mesotron concn. is a max. at an altitude of 17 km. F. R. G.

Integer spin mesons. M. Schoenberg (*Physical Rev.*, 1941, [ii], **60**, 468).—Mathematical. For a spin 0 field the meson theory has two forms, scalar or pseudo-scalar wave functions, and, analogously, for a spin 1 field the potentials may be components of a four vector or of a pseudo-four vector. The two forms of the meson theory, for each of the vals. 0 and 1 of the spin, are shown to be equiv., and only one kind of particle is possible in each case. N. M. B.

Cosmic-ray latitude effect and the single primary component hypothesis. W. F. G. Swann (*Physical Rev.*, 1941, [ii], **60**, 470—471).—On the assumption that a single primary component produces mesotrons at a definite altitude in the stratosphere, an expression is found for the no. of mesotrons at a given distance below the point of production. This expression is used to examine the sea-level latitude effect, attributed to mesotron intensity, with the assumption involved that a proton gives rise to 5 mesotrons at 20 km. altitude. N. M. B.

Mesotron shower. E. O. Wollan (*Physical Rev.*, 1941, [ii], **60**, 532).—A photograph obtained at 15,500 ft. altitude shows 10 rays diverging from a point in a 15-cm. Pb block above the cloud chamber. One is probably a slow mesotron and most of the others seem to be mesotrons produced in the Pb by the explosive type of production. N. M. B.

Protonic nature of the primary cosmic radiation. G. Cocconi (*Physical Rev.*, 1941, [ii], **60**, 532—533; cf. Schein, A., 1941, I, 289).—Evidence is given that there exists at sea level an electronic (" residual ") component of a nature different from that arising from mesotron decay. Hence it is deduced that, if the intensity of the cosmic radiation at sea level is taken as 1, the mesotron component is 0·8, the electronic component arising from decay 0·08, the interaction component 0·04, and the residual component 0·08. At ~8 cm. Hg pressure the respective vals. are 8·0, 8·0, 0·4, and 30. It is concluded that the primary protons produce the mesotrons in the atm., and, directly and indirectly by unknown processes, the photons and electrons responsible for large showers and the residual component. N. M. B.

Strongly ionising particles in cosmic-ray showers. G. Cocconi (*Physical Rev.*, 1941, [ii], **60**, 533).—In Wilson cloud-chamber experiments on narrow showers generated in Al a photograph was obtained of two strongly ionising particles, one of them showing several δ-rays. The photograph indicates that in a narrow shower, made up mostly of electrons, nuclear evaporation processes can occur. N. M. B.

Positive excess in mesotron spectrum. G. Bernardini, G. C. Wick, M. Conversi, and E. Pancini (*Physical Rev.*, 1941, [ii], **60**, 535—536).—A repetition, with an improved triple coincidence arrangement, of the experiments of Rossi (cf. A., 1931, 1350) confirms the presence of an excess of

positive particles (cf. Hughes, A., 1940, 1, 279). An evaluation of the " allowed cone " of incident directions permits an approx. quant. interpretation of the results. N. M. B.

Mesotron variation with upper air temperature. V. F. Hess and F. A. Benedetto (*Physical Rev.*, 1941, [ii], **60**, 610—611).—Curves are given and discussed for the temp. coeff. as a function of mesotron intensity at ground and temp. at given levels and for mean mass temp. between ground and levels corresponding with given fractions of a standard atm. The new method of taking mean temp. is to integrate the pressure–temp. curve and divide by pressure; thus the more fundamental air mass plays its part in obtaining mean temp. Deductions based on the curves are examined. The calc. " life range " of the mesotron is 12·5 km., and rest lifetime $\sim 10^{-6}$ sec. for the more energetic part of the mesotron spectrum. N. M. B.

Meson lifetime and radioactive β-deeay. S. Rozental (*Physical Rev.*, 1941, [ii], **60**, 612—613).—Mathematical. An examination of the possibility of removing, by a suitable choice of consts., the discrepancy between the meson lifetime as estimated from cosmic-ray measurements and from β-ray decay. N. M. B.

Energy spectrum of the primary cosmic rays. C. S. Hu (*Physical Rev.*, 1941, [ii], **60**, 614).—A calculation of the energy spectrum based on the data of Bowen (cf. A., 1938, I, 382). N. M. B.

Latitude effect and the decay of mesotrons. R. T. Young, jun. (*Physical Rev.*, 1941, [ii], **60**, 614—615).—Calculations show that the independence of the latitude ratio at a given altitude with reference to thickness of Pb shielding up to 20 cm. (cf. A., 1937, I, 594) can be explained by mesotron decay. N. M. B.

Motion of gases in the sun's atmosphere. III. Stratification of the solar envelope. A. K. Das (*Indian J. Physics*, 1941, **15**, 79—93).—A dynamical theory of the motion of gases in the sun's atm. is used to evolve a mode of formation and maintenance of the different layers of the solar envelope. It yields heights of the reversing layer, the chromosphere, and the quiescent prominences. W. R. A.

Difficulties in the field theory of exchange forces. E. C. G. Stueckelberg (*Physikal. Z.*, 1940, **41**, 523—524).—The Yukawa theory with exchange of charge and spin moment leads to a complicated system of nuclear forces, and not to a " Yukawa potential." A. J. E. W.

Finite self-energies in radiation theory. II. A. Landé and L. H. Thomas (*Physical Rev.*, 1941, [ii], **60**, 514—523; cf. A., 1941, I, 397).—Mathematical. The " cutting-off method " previously proposed is equiv. to a field theory based on Maxwell's equations supplemented by Yukawa's equations, both fields having the same point charges as sources. The chief result is a finite self-energy $W = e^2/2r_0$ and a modified Coulomb potential $(e/r)[1 - \exp.(-r/r_0)]$, also derivable from a Hamiltonian in Fourier form. For accelerated motions the field theory yields a finite force of inertia, with the universal damping term in first approximation. Small additional terms reflect the " structure " of the electron. Radiation and self-force of a vibrating electron are discussed and the perturbation problem is formulated. The exact integration of Yukawa's field equation is given. Results are related to the Born–Infeld unitary field theory and to Dirac's theory of the classical electron. The electronic mass m is the result of photons of rest mass 0 and mesons of rest mass $M = m \times 2 \times 137$. N. M. B.

Exchange forces between neutral molecules and a metal surface. W. G. Pollard (*Physical Rev.*, 1941, [ii], **60**, 578—585; cf. A., 1941, I, 402).—Mathematical. A Heitler–London treatment of the exchange part of the mutual energy of a neutral atom and a metal is developed. The resulting interactions are evaluated by a simplified model of the metal and lead to a simple expression for the total exchange energy. This expression is applied to the interaction of H_2 and He with metals, where it is found to represent a repulsion. By adding this exchange interaction to the attractive van der Waals interaction between the mol. and the metal, a potential curve of the usual type, having a min., is obtained for each system. The depths of the min. are compared with observed heats of van der Waals adsorption. N. M. B.

Special relativity in refracting media. W. C. Michels and A. L. Patterson (*Physical Rev.*, 1941, [ii], **60**, 589—502).—Mathematical. A reformulation of the Lorentz transformations for an observer in a refracting but non-dispersive medium is suggested. The speed of light signals in the medium replaces the free space speed which appears in the usual form. The Fresnel drag coeff. takes the same form in the new formulation as in the old, and the mechanics of the photon lead to correct expressions for Snell's law and for the pressure of radiation at the boundary of the medium. N. M. B.

II.—MOLECULAR STRUCTURE.

Intensities in perturbations. G. H. Dieke (*Physical Rev.*, 1941, [ii], **60**, 523—529; cf. A., 1935, 917).—Mathematical. Formulæ for the intensities of lines from a pair of interacting states to a common lower state are applied to perturbations in band spectra. In the rotational perturbations there is a direct superposition of intensities of the two interacting states, but in vibrational perturbations interference effects give an entirely different result. The general formulæ are applied to a few cases in the H_2 spectrum. N. M. B.

Structure of the electronic bands of OD. II. M. G. Sastry (*Indian J. Physics*, 1941, **15**, 95—102).—The (3, 0) band of OD at 2569 A. has been photographed with 5 hr. exposure and the rotational structure analysed. The consts. are B_3' 8·13 and B_0'' 9·94 cm.$^{-1}$ and the spin-coupling const. A is −139·6 cm.$^{-1}$ (Cf. A., 1941, I, 445.) W. R. A.

Band spectrum and structure of BCl. G. Herzberg and W. Hushley (*Canad. J. Res.*, 1941, **19**, A, 127—137).—The $^1\Pi$—$^1\Sigma^+$ system of BCl, excited by an uncondensed discharge through He containing some BCl_3 vapour, has been photographed in high dispersion and the rotational and vibrational structure analysed. Miescher's interpretation of the vibrational structure (A., 1935, 144) is modified. The mol. consts. of BCl are calc. and compared with those of the isoelectronic mols. CS, PN, and SiO, and with those of BCl_3, BBr, and BBr_3. O. D. S.

Internuclear distance in the fluorine molecule. M. T. Rogers, V. Schomaker, and D. P. Stevenson (*J. Amer. Chem. Soc.*, 1941, **63**, 2610—2611).—From electron diffraction measurements on F_2 the internuclear distance is 1·435±0·010 A. in the normal state. W. R. A.

Rotational analysis of the 2900 A. band of CO_2^+. F. Bueso-Sanllehí (*Physical Rev.*, 1941, [ii], **60**, 556—570).—The doublet band near λ 2896 and λ 2882 was photographed in the third order of a 30-ft. grating spectrograph with dispersion 0·22 A. per mm. and resolving power 300,000. Full data and rotational analysis are tabulated. The structure is explained by a $^2\Sigma_u^+ \rightarrow {}^2\Pi_g$ (case *a*, inverted) transition, where $^2\Pi_g$ is the ground state of CO_2^+. Alternate lines are missing, as expected for $^2\Sigma$ in view of the zero spin of the O nuclei. Perturbations, involving displacements and weakening of the lines, are observed, and are caused probably by higher vibrational levels of a $^2\Pi_u$ state ~0·8 v. below $^2\Sigma_u^+$. J vals. and mol. consts. are evaluated. N. M. B.

Rotational analysis of some carbon bisulphide bands in the near ultra-violet system. L. N. Liebermann (*Physical Rev.*, 1941, [ii], **60**, 496—505; cf. A., 1940, **I**, 386).—Six bands in the λ 3100 system of CS_2, photographed in absorption with a 30-ft. grating spectrograph, were analysed, and B vals. are given for their initial and final states. The structure is of the simple PR branch type, all observed bands originating from $^1\Sigma_u^+$—$^1\Sigma_g^+$ transitions. The bands at λλ 3468, 3501, and 3535 originate in the normal state, giving $r_0 = 1{\cdot}548$ A. for the normal C–S separation. A partial vibrational analysis shows that for the bending vibration, $2\nu_2'' = 802$ cm.$^{-1}$ Two progressions, $v_2'' = 0$ and $v_2'' = 2$, indicate that $\nu_2' = 270$ cm.$^{-1}$ The λλ 3501 and 3601 bands have their common upper $^1\Sigma_u^+$ state perturbed by a $^1\Pi_u$ state. The perturbation analysis gives consts. in good agreement with observation, and gives the B val. for the perturbing $^1\Pi_u$ state. There is evidence that the excited electronic state of CS_2 is bent (cf. following abstract), but even if the mol. is bent to 125°, the P and R series may still be represented by a simple quadratic formula, as for a linear mol., for J vals. <25. N. M. B.

Correlation of energy levels of linear and bent triatomic molecules, and the ultra-violet carbon disulphide absorption spectrum. R. S. Mulliken (*Physical Rev.*, 1941, [ii], **60**, 506—513; cf. A., 1941, I, 319).—A set of vibronic levels for a $^1\Sigma_g^+$ and a $^1\Pi_g$ electronic state of linear AB_2 is shown in a diagram, together with gyrovibronic levels of the corresponding electronic states of bent AB_2 (cf. preceding abstract), and a correlation between the sets of gyrovibronic levels in the two cases is set up. The diagram is used in a discussion of the near ultra-violet absorption bands of CS_2, where the mol. is linear in the $^1\Sigma_g^+$ ground state. Band types and structures, vibrational intensities, and their relation to a strong allowed electronic transition at shorter $\lambda\lambda$, are discussed. It is concluded that the near ultra-violet system is an electronic-allowed transition to a $^1B_2$ bent mol. upper state related to a $^1\Pi_g$ linear mol. state. N. M. B.

Optical Dewar vessel.—See A., 1942, **I**, 27.

Vibration–rotation energies of the planar XY_3 molecular model. S. Silver and W. H. Shaffer (*J. Chem. Physics*, 1941, **9**, 599—606).—Mathematical. The vibration–rotation energies of this mol. model have been investigated to the second order of approximation. J. W. S.

Rotation–vibration energies of the pyramidal XY_3 molecular model. W. H. Shaffer (*J. Chem. Physics*, 1941, **9**, 607—615).—Mathematical. Complete expressions for the rotation–vibration energies of this mol. model are derived in such a way as to include contributions from Coriolis interactions, anharmonicities, etc. J. W. S.

Intensities of infra-red vibration–rotation absorption bands of gases. A. J. Wells and E. B. Wilson, jun. (*J. Chem. Physics*, 1941, **9**, 659).—The apparent absorption coeff. (a) of the gas is measured in the presence of a sufficiently high pressure of non-absorbing foreign gas to eliminate rotational fine structure and the vals. of fa/p (p = partial pressure of absorbing gas) are extrapolated to $p = 0$. The results of applying the method to the fundamental bands of N_2O and C_2H_4 are recorded. J. W. S.

Refraction and absorption of unsaturated compounds. N. A. Sörensen (*Annalen*, 1940, **546**, 57—98).—Formulæ are given for computing at. and constitutive refractions from data on ultra-violet spectra. The new vals. differ but slightly from those of Eisenlohr for corresponding $\lambda\lambda$. The views advanced are tested on C_2HMe_3, $COMe_2$, 10 polyenes, 4 " semi "-aromatic and 3 aromatic compounds. Vals. from spectral and dispersion data are compared. W. R. A.

Analysis of absorption spectra. II. Physicochemical properties and mechanism of electrochemical reduction of the chromophoric nitrosobenzene group. E. Hertel and F. Lebok (*Z. physikal. Chem.*, 1940, **B**, **47**, 315—342; cf. A., 1940, I, 6).—Absorption spectra of PhNO, its NO_2, Cl, OH, NMe_2, and NEt_2 p-derivatives, and of p-$NMe_2{\cdot}C_6H_4{\cdot}NO_2$, all in EtOH–dil. H_2SO_4 solution, have been examined in the manner previously described, over the range 10,000—40,000 cm.$^{-1}$. The spectra of $OH{\cdot}C_6H_4{\cdot}NO$ indicate that only 20% exists in this form, the remainder being present as $O{:}C_6H_4{:}N{\cdot}OH$. The absorption due to ·NO in the long-wave region is entirely suppressed in the NMe_2- and NEt_2- and partly in the OH-derivatives in acid solution, whence it is inferred that these groups impart to the NO basic properties which cause it to combine with H ions. This inference is borne out by the large increase (2—3 D.) in the dipole moment caused by these groups, and by the easier electro-reducibility of the derivatives containing them. Experiments showing the electrochemical behaviour of the various compounds are described and a scheme for the mechanism of their electro-reduction is given. The p-substituents fall in the same order of increasing effect with respect to their influence on the displacement of the long-wave absorption max., the dipole moment, and the electrochemical reactivity, viz., $NO_2 < Cl < H < OH < NMe_2 < NEt_2$. F. L. U.

Absorption spectra of some substituted nitrosobenzenes and the resonance effect of the substituent. Y. Tsuzuki, T. Uemura, and N. Hirasawa (*J. Chem. Soc. Japan*, 1950, **61**, 1063—1066; *Rev. Phys. Chem. Japan*, 1941, **15**, 132).—Substitution of Me into PhNO has only a small effect on absorption spectra, the effect decreasing in the order p->o->m-substitution. The substituted compounds are bathochromic. The data are discussed in conjunction with those of other investigations. C. R. H.

Metallic complexes co-ordinating the hydroxy-compounds. I. Effect of alkali on polyhydric alcohols or hydroxy-acids in aqueous solution. II. Formation and absorption spectra of polyhydric alcohol–copper–alkali complex solution. III. Absorption spectra of tartaric acid–copper–alkali complex solutions. IV. Optical activity of tartaric acid–copper–alkali complex solutions and structure of the complex radicals. M. Kubota (*J. Chem. Soc. Japan*, 1940, **61**, 1176—1181, 1182—1186, 1256—1260, 1261—1268; *Rev. Phys. Chem. Japan*, 1941, **15**, 133).—I. The light absorption of polyhydric alcohols increases with alkali concn. owing to the electrostatic effect of the alkali-metal ion on the alcoholic OH groups. At high concns. complex compounds of alcohol and central alkali-metal ions are formed. The light absorption of OH-acids is weakened by alkalis as a result of acid dissociation. At high alkali concns. light absorption increases at long $\lambda\lambda$.

II. The absorption spectra and conditions of formation of glycerol– and mannitol–Cu–NaOH complexes in solution have been investigated.

III. Until [NaOH] is equiv. to tartaric acid + $CuSO_4$, the second absorption band of complexes moves to lower $\lambda\lambda$ and the special absorption band moves to higher $\lambda\lambda$. At high [NaOH] both bands move to lower $\lambda\lambda$ and the stability of the complexes increases.

IV. The optical activity of tartaric acid–$CuSO_4$ solutions increases, decreases, and increases again as NaOH is added. The structures of complex radicals in solution are discussed. C. R. H.

Classification of electronic bands in solution spectra. IV. Light absorption of nitrogen–oxygen acids and their salts. G. Kortüm and B. Finckh (*Z. physikal. Chem.*, 1940, **B**, **48**, 32—49).—The empirical rule that observed electronic bands can be attributed to definite chromophores in mesomeric systems with conjugated double bonds has been tested for the spectra of inorg. N–O acids and their derivatives, pernitrite and hyponitrite ions, HNO_2, $NH_2{\cdot}NO_2$, $NHMe{\cdot}NO_2$, $NMe_2{\cdot}NO_2$, $NO_2{\cdot}NH{\cdot}OH$ and $NO{\cdot}NMe{\cdot}OH$ anions. The spectra of aq. CH_2N_2 and $CHN_2{\cdot}CO_2Et$ are compared. Ascertained bands are attributed to $-NO_2$, $>C{:}N-$, $-N{:}N-$, $-N{:}O$, and $-O{\cdot}O-$, and the participation of different electromeric ground structures to the stationary states of mols. is discussed. In most cases the spectra indicate the presence of tautomerides in equilibrium. W. R. A.

Influence of restricted rotation on the absorption spectra of aryl-substituted aromatic hydrocarbons. R. H. Jones (*J. Amer. Chem. Soc.*, 1941, **63**, 1658—1661).—Absorption spectra of 9 : 10-dihydrophenanthrene and its 4 : 5-CH_2· derivative correspond approx. (except for a bathochromic effect) with that of Ph_2. 9-Aryl and 9 : 9-diaryl substitution does not much alter the absorption of anthracene; for this series and for $2\text{-}C_{10}H_7Ph$ the spectra can be calc. from those of the constituent aromatic nuclei. The above results and those for porphin derivatives support the view that approx. co-planar structure is necessary for development of the Ph_2 spectrum and that conjugated aromatic chromophores contribute additively to the total absorption when unable to become co-planar. R. S. C.

Ultra-violet absorption spectra of iodised casein and thyroglobulin. A. D. Marenzi and F. Villalonga (*Rev. Soc. argent. Biol.*, 1941, **17**, 270—274).—It is deduced from absorption spectra data that thyroxine is formed by iodination of casein by the combination of I with thyronine pre-existing in the casein mol. J. T. L.

Ultra-violet absorption spectra of thyroxine and allied substances. A. D. Marenzi and F. Villalonga (*Rev. Soc. argent. Biol.*, 1941, **17**, 262—269).—Determinations were made with the Zeiss spectrograph using W arc light and results plotted suitably. The lowest val. for AK (difference between mol. extinction at the highest and lowest point of the curve) found was for $OPh{\cdot}C_6H_4{\cdot}OH$-$p$. Iodination of this substance or of the phenol nucleus increased the AK and the val. of d (difference in λ at max. and min.). J. T. L.

Ultraviolet absorption-spectra of barbitone and phenobarbitone and their methyl derivatives.—See A., 1942, II, 32.

Soret absorption bands in the ultra-violet. C. Dhéré (*Arch. Sci. phys. nat.*, 1941, [v], **23**, 137—165).—A review of the work of Soret on the ultra-violet absorption of proteins and

oxyhæmoglobin is given. An extensive bibliography is provided. A. J. M.

Electron energy-levels in biochemistry.—See A., 1942, III, 57.

Ultra-violet absorption spectrum of crystalline ribonuclease.—See A., 1942, III, 58.

Photochemical absorption spectra of the Pasteur enzyme and the respiratory enzyme in yeast.—See A., 1942, III, 172.

Raman effect. CXVII. Rotation isomerism. IX. Alkyl polyhalides. L. Kahovec and J. Wagner (*Z. physikal. Chem.*, 1940, **B**, **47**, 48—54).—The Raman spectra of CMe_2Br_2, CMe_2I_2, $CHMeI_2$, $CH_2Br{\cdot}CHBr_2$, $(CMe_2Cl)_2$, and $(CMe_2Br)_2$ have been determined, and those of $CH_2Cl{\cdot}CHMeCl$, $CH_2Br{\cdot}CHMeBr$, $CH_2(CH_2I)_2$, and *iso*-C_5H_{12} have been redetermined. In the spectra of the isomeric dihalogenopropanes there is an increase in the no. of lines in the frequency range <800 cm.$^{-1}$ from 6 to 8 to 10 on passing from $\beta\beta$-compounds (fixed chain) to the $\alpha\beta$-compounds (single rotation) to the $\alpha\gamma$-compounds (double rotation). Rotation isomerism occurs in the last two types. A similar increase in the no. of lines is observed for the C–halogen valency frequencies of the $CH_2X{\cdot}CHX_2$ (X = halogen) compounds, indicating rotation isomerism. A. J. M.

Raman effect. CXVIII. Rotation isomerism. X. Dihalogenoethanes. K. W. F. Kohlrausch and H. Wittek (*Z. physikal. Chem.*, 1940, **B**, **47**, 55—65).—The Raman spectra of $(CH_2Cl)_2$, $(CH_2Br)_2$, $CH_2Cl{\cdot}CH_2Br$, and $CH_2Cl{\cdot}CH_2I$ have been redetermined with greater accuracy and the polarisation of the lines of the first three has been investigated. The available data on the spectra of the dihalogenoethanes are analysed. The assumption of the coexistence of *cis*- and *trans*-forms explains almost all the characteristics of the vibration spectra of these compounds in the liquid state, with respect not only to the chain frequencies but also to the CH-group frequencies. A. J. M.

Raman effect. CXIX. Tetrachloroethylene. H. Wittek (*Z. physikal. Chem.*, 1940, **B**, **48**, 1—6).—The Raman spectrum of C_2Cl_4 has been investigated at different dispersions and the depolarisation factors of the principal lines have been measured. The data are in accord with those calc. from a valency force model. The spectra of C_2X_4 (X = H, D, Me, Cl, Br) are compared. W. R. A.

Raman effect. CXX. Rotation isomerism. X. Halogen-substituted butane. L. Kahovec and K. W. F. Kohlrausch (*Z. physikal. Chem.*, 1940, **B**, **48**, 7—11).—The Raman spectra of $Bu^{\alpha}Cl$, $Bu^{\alpha}SH$, $Bu^{\alpha}Br$, $Bu^{\alpha}I$, $CH_2Cl{\cdot}CHEtCl$, $CH_2Br{\cdot}CHEtBr$, $CH_2Cl{\cdot}CMe_2Cl$, $CH_2Br{\cdot}CMe_2Br$, $CMeEtCl_2$, $CMeEtBr_2$, $(CHMeCl)_2$, and $CHMe(CH_2Cl)_2$ are recorded and the spectra of homologues of $(CH_2Cl)_2$ and $(CH_2Br)_2$ are discussed. W. R. A.

Absence of electronic Raman effect. L. Sibaiya (*Physical Rev.*, 1941, [ii], **60**, 471).—Three new bands provisionally ascribed to an electronic Raman effect in Sm^{+++} (cf. A., 1939, I, 550) are shown to arise from a selective absorption by Sm ions from the continuous background of the Hg arc. Absence of evidence from Tl or Sm ions in the optical and *X*-ray regions indicates the non-existence of an electronic Raman effect. N. M. B.

Raman effect in single crystals of potassium nitrate. T. M. K. Nedungadi (*Proc. Indian Acad. Sci.*, 1941, **A**, **14**, 242—256).—Three new displacements of 100, 126, and 143 cm.$^{-1}$ are reported and assigned to lattice oscillations. These $\nu\nu$ disappear at $\sim$120°, just $<$ the temp. of transition (129°) from orthorhombic to trigonal symmetry. The other lattice oscillations (52 and 82 cm.$^{-1}$) broaden and shift to lower $\nu\nu$ with increase of temp. The displacements due to internal oscillations remain practically const. up to 290°, but the components (1343 and 1361 cm.$^{-1}$) of the degenerate NO_3' ion oscillation broaden and merge into each other at $>$170°. Molten $NaNO_3$ shows further broadening of the split-components, but the $\nu\nu$ 710 and 1050 cm.$^{-1}$ are unchanged by the change of state. The spectra obtained with different crystal orientations and different polarisations of incident and scattered radiation satisfy the selection rules for orthorhombic symmetry. The strong birefringence of the crystal causes internal $\nu\nu$ to appear more strongly when the incident radiation vector is in the plane of the NO_3 group than when it is perpendicular to the plane. The polarisation characteristics of lattice oscillations are generally the reciprocal of those of internal oscillations. In cryst. $NaNO_3$ both 714 and 1350 cm.$^{-1}$ split up into a symmetric and an antisymmetric oscillation; the separation of the split-components of 1350 cm.$^{-1}$ is $>$ that of 714 cm.$^{-1}$ W. R. A.

Effect of crystal orientation on the Raman spectrum of barytes. T. A. S. Balakrishnan (*Proc. Indian Acad. Sci.*, 1941, **A**, **14**, 257—264).—Spectra of single crystals of barytes have been examined under three different orientations. The frequency ν_2 of the SO_4'' ion splits into two components at 452 and 458 cm.$^{-1}$; ν_3 exhibits four lines at 614, 620, 638, and 650 cm.$^{-1}$; ν_4 yields eight components at 1038, 1082, 1088, 1109, 1136, 1142, 1158, and 1170 cm.$^{-1}$; and ν_1 remains single at 989 cm.$^{-1}$ The complete spectrum is not given by any one orientation, and lines common to different orientations differ in intensities. From investigations with incident radiation polarised in and perpendicular to the plane of observation it is concluded the frequencies 452, 458, 650, 989, and 1170 cm.$^{-1}$ are symmetrical and all other frequencies are antisymmetrical vibrations. W. R. A.

Raman spectra of *cyclo*pentane and its monoalkyl derivatives. E. J. Rosenbaum and H. F. Jacobson (*J. Amer. Chem. Soc.*, 1941, **63**, 2841—2842).—Raman displacements are given for *cyclo*pentane, its Me, Et, Pr$^{\alpha}$, Pr$^{\beta}$, Bu$^{\alpha}$, *sec.*-Bu, Bu$^{\gamma}$, and *tert.*-C_5H_{11} derivatives, and γ-*cyclo*pentylpentane. W. R. A.

Multipole nature of elementary sources of radiation: wide-angle interference. S. Freed and S. I. Weissman (*Physical Rev.*, 1941, [ii], **60**, 440—442).—In wide-angle interference experiments it is possible to analyse radiation with respect to its multipole character. The fluorescence from Eu ions in solution consisted of different kinds of radiation in that they had different interference properties. From the behaviour of the fringe systems, one group of spectral lines was identified as arising from magnetic dipoles, and two other groups from the forced oscillations of electric dipoles. The multipole character of the radiation of a quantum transition was modified by a change in the microscope fields about the emitting ions. N. M. B.

Fluorescence of chlorophyll and photo-synthesis.—See A., 1942, I, 69.

Luminescence of sulphide and silicate phosphors. R. P. Johnson (*J. Opt. Soc. Amer.*, 1939, **29**, 387—391).—In the proposed mechanism for the luminescence of sulphides, excitation involving ionisation of an activator atom is followed by localisation of the dissociated electron in a discrete energy level in the forbidden region. The electron can only recombine with an ion, emitting the characteristic luminescence, after being freed from this trapped state, *e.g.*, by thermal excitation. In the case of silicate phosphors, it is assumed that each activator atom contributes two localised forbidden states. L. J. J.

Polarisation of luminescence of ruby. B. V. Thosar (*Physical Rev.*, 1941, [ii], **60**, 616).—The state of polarisation of the intense red lines $\lambda\lambda$ 6927 and 6947 emitted by a synthetic single crystal of ruby when optically excited is investigated. The direction of vibration in nearly the whole of the red emission is in a plane perpendicular to the optic axis. The crystal is dichroic. Absorption and luminescence appear to be confined to the plane perpendicular to the optic axis, and the two processes are related, for, with the exciting light plane-polarised, the intensity of red luminescence is greatest when the optic axis is so oriented that the crystal has the strongest absorption in the green-yellow ($\lambda\lambda$ 5300—5800) region. An explanation of results is discussed. N. M. B.

Supersonic cell fluorometer.—See A., 1942, I, 27.

Anomalous crystal photo-effect in *d*-tartaric acid single crystals. K. L. Chung (*Physical Rev.*, 1941, [ii], **60**, 529—531).—The current-reversal anomaly reported by Brady (cf. A., 1939, I, 181) for imperfect crystals was found for all clear, well-formed, single crystals when light falls on certain points of the crystal surface. These points always lie between two regions which respond with normal current flows in opposite directions. The superposition of the two normal current–response curves gives a resultant which agrees with the observed current-reversal curve. The various current–response curves for different illuminated crystal faces, including the current-reversal effect, are correlated by assuming

a particular direction in the unit cell for which the electrical conductivity is a max. N. M. B.

Photo-electric alloys of alkali metals.—See A., 1942, I, 17.

Electrical properties of solids. XI. Polyvinyl acetate and polyvinyl chloroacetate. D. J. Mead and R. M. Fuoss (*J. Amer. Chem. Soc.*, 1941, **63**, 2832—2840; cf. A., 1941, I, 202).—The electrical properties of polyvinyl chloroacetate (I) from −80° to 70° and two polyvinyl acetates (II) and (III), the wt. average mol. wt. of (II) to (III) being 2·2 : 1 from 30° to 100°, have been studied from 60 cycles to 10,000 cycles. The moment per monomeride unit (μ) of (I) is 4·9 D. and for (II) and (III) 2·3 D. (I), (II), and (III) in the high-temp. range exhibit absorption due to dipole rotation. The times of relaxation are distributed about a val. ∝ the mol. wt. of the polymeride and the distribution is sharper than for linear polymerides of polyvinyl chloride because rotation about the O atoms linking the dipoles to the chain frees the dipoles from restrictions imposed by convolutions of the chain. Static dielectric consts. are ≪ the consts. of the corresponding monomerides and are attributed to diminished association of the dipoles in the polymerides produced by the restrictions on translational motion imposed by the bond on the chain. Further evidence that the d.c. conductance can be used as a measure of η is given, both conductance and the time of polar relaxation being exponential in $1/\theta$ and having approx. the same temp. coeff. Discrepancies observed in the electrical properties when the period of the impressed field is short compared with the time of elastic relaxation are discussed and tentative explanations given. W. R. A.

Electric polarisation and molecular vibrations. Ethylene dihalides and diacetyl. G. I. M. Bloom and L. E. Sutton (*J.C.S.*, 1941, 727—742).—The polarisations of fumaronitrile and $(CH_2{\cdot}CN)_2$ have been determined in C_6H_6, those of $(CH_2Cl)_2$ and $(CH_2{\cdot}CN)_2$ in dioxan, and those of dimethylketazine, $(CH_2Cl)_2$, $(CH_2Br)_2$, and $(CH_2{\cdot}CN)_2$ in the vapour phase. Preliminary results for Ac_2 are also recorded. The determinations in solution were made at 25°, and those in the vapour phase over a range of temp. These compounds might be expected to show large vibration polarisations. The results are discussed with particular reference to the variation of the moment with temp. If there is an equilibrium between *cis*- and *trans*-isomerides, the graph of the log of the ratio of their concns. against $1/\theta$ should be linear. This is actually found to be the case with the data now recorded, and those of other workers. This result does not, however, exclude the alternative theory that there is restricted rotation about the *trans*-position. Dipole and electron diffraction data do not agree with the interpretation of the Raman spectra of $(CHCl_2)_2$ and of *cyclo*hexane as signifying that there are stable isomerides of these mols. in which non-bonded atoms approach as closely as possible. A similar interpretation for the case of $(CH_2Cl)_2$ may also be regarded as incorrect. If the "*trans*-vibration" theory be accepted, the results confirm the conclusion that the forces between the two rotatable halves of the ethylene dihalide mols. are mainly steric forces, the repulsion being the greater the larger are the halogens. In the case of Ac_2 there is a very strong tendency for the mol. to be planar, which may be attributed to resonance. A. J. M.

Inductive mechanism of dipole interaction and the estimation of molecular dipole moments. A. E. Remick (*J. Chem. Physics*, 1941, **9**, 653—658).—It is suggested that mols. can be considered as substitution products of a simple system of reference compounds of which the bond moments are altered by substitution to an extent characteristic of the substituent. Assuming that only inductive electron displacement is operative in saturated mols., equations for calculating the dipole interactions are derived. The dipole moments of halogen derivatives of CH_4 and C_2H_6 calc. on this basis are in approx. accord with experiment, especially when certain empirical changes in the vals. of the electronic polarisations of the groupings are introduced. J. W. S.

Measurement of dipole moments of free radicals. G. Karagunis and T. Jannakopoulos (*Z. physikal. Chem.*, 1940, **B**, **47**, 343—356).—Experimental procedure for measuring the dipole moment (μ) of free radicals is described. For CPh_3 and $C(C_6H_4Ph)_3$ dissolved in C_6H_6 $\mu = 0$, from which it is inferred that the field due to the single electron is distributed uniformly over the entire mol. An analogy between the electrical condition of CPh_3 and that of NPh_3, for which also $\mu = 0$, is developed. F. L. U.

Dispersion due to weak absorption bands. K. F. Herzfeld (*J. Opt. Soc. Amer.*, 1939, **29**, 355—357).—Formulæ for the evaluation of the dispersion curve in the neighbourhood of a weak band are developed, enabling the transition probability to be calc. from the difference in height of max. and min. in the curve. L. J. J.

Infra-red dispersion of $CHCl_3$ and $CHBr_3$. M. A. Pittman (*J. Opt. Soc. Amer.*, 1939, **29**, 358—363).—Data, obtained by the use of two infra-red spectrometers of conventional design in series, are recorded for the refractive index (n) of $CHCl_3$ and $CHBr_3$ at 20°, for $\lambda\lambda$ 0·589—13·00 μ. From the vals. obtained for the dispersion in the neighbourhood of the absorption bands at 3·28 μ. and 8·4—8·8 μ., the oscillator strengths (f) of the bands are evaluated by Herzfeld's method (cf. preceding abstract). f vals. $1{\cdot}27 \times 10^{-3}$ at 3·28 μ. and $2{\cdot}87 \times 10^{-3}$ at 8·4 μ. are found for $CHCl_3$, and $2{\cdot}21 \times 10^{-3}$ at 3·29 μ. and $5{\cdot}46 \times 10^{-3}$ at 8·8 μ. for $CHBr_3$. L. J. J.

Optics of atmospheric haze. E. O. Hulburt (*J. Opt. Soc. Amer.*, 1941, **31**, 467—476).—The attenuation of light passing through the atm. near sea level, and the angular distribution of the scattered light, have been measured for atm. conditions ranging from very clear to foggy. The attenuation was determined from measurements of the brightness of a large approx. black body at a distance of 3·2 km., and of the brightness of the sky just above the black body. The angular distribution of the scattered light was determined from measurements of the brightness at various angles of a searchlight beam at night, and by measuring the brightness of the horizon sky at various azimuths for a moderately low sun and a cloudless sky. The distribution was not greatly affected by the thickness of the haze. The forward scattering predominated. A. J. M.

New methods in the study of light scattering. I. Basic ideas. (Sir) C. V. Raman. **II. Pure liquids.** T. A. S. Balakrishnan (*Proc. Indian Acad. Sci.*, 1941, **A**, **14**, 228—234, 235—241).—I. A lecture. The incident beam is polarised in any desired azimuth by a Nicol and transversely scattered light is observed by a Babinet compensator. The sensitiveness of the method, its use with ultra-violet radiation, its application to the detection and measurement of the elliptic polarisation of the light scattered by uniform, spherically-symmetrical particles are discussed.

II. Feebly-polarised scattered radiation is shown by the presence of fringes when the scattered radiation is viewed through the Babinet compensator; CCl_4 and Et_2O exhibit fringes, but C_6H_6 does not. The fringes for CCl_4 and Et_2O become more pronounced at lower $\lambda\lambda$ of incident radiation. W. R. A.

Optical and magnetic properties of ferromagnetic suspensions. W. C. Elmore (*Physical Rev.*, 1941, [ii], **60**, 593—596).—Mathematical. A modification and extension of the theory proposed by Heaps (cf. A., 1940, I, 254) is developed and various new experiments, suggested by the theory, to give additional information on the magnetisation of ferromagnetic particles, are devised and discussed. N. M. B.

Density distribution and energy spectrum of *B*-electrons. V. Calculation of diamagnetic anisotropy of aromatic substances from the density distribution of *B*-electrons obtained on the basis of the "box" model. O. Schmidt (*Z. physikal. Chem.*, 1940, **B**, **47**, 1—47).—Aromatic compounds show particularly high vals. of the diamagnetic anisotropy (difference between magnetic susceptibilities in the direction of the plane of the mol., and perpendicular to it). This is usually due to the presence of valency electrons not in simple linkings (*B*-electrons). *B*-electrons in the plane of the mol. capable of free rotation will perform circular or elliptical orbits under the action of a magnetic field perpendicular to the plane. The radius of the orbit is defined by the form of the mol. and the radial distribution of electrons, which can be calc. by the aid of the "box" model. A magnetic field in the plane of the mol. has no effect on the orbits of the *B*-electrons. Hence the large val. of the diamagnetic anisotropy in aromatic compounds is due to their two-dimensional structure. The properties of *B*-electrons in aromatic compounds are similar to those of the free conductivity electrons in metals. Since the single variable in the Langevin formula for susceptibility is the mean square of the radii of the electron orbits, it follows that the diamagnetic

anisotropy can be calc. from the distribution of *B*-electrons based on the " box " model. Such calculations lead to results in satisfactory agreement with experiment. The root-mean-square radii of the *B*-electrons are given for various types of aromatic hydrocarbons, and for graphite. The problem of the connexion between superconductivity and diamagnetism is discussed. A. J. M.

Quantum-mechanical calculations applied to the theory of organic dyes. II. T. Förster (*Z. physikal. Chem.*, 1940, **B**, **48**, 12—31).—By means of quantum-mechanical perturbation calculations a rule for the influence of substituents in ions of dyes having three-fold symmetry is derived. This rule qualitatively predicts the change in the position of the absorption regions caused by the step-wise introduction of similar auxochromic groups in the three branches of the ions, the influence of substituted auxochromic groups of different kinds on the location of absorption regions, the effects of ring-closure, and the effects of introducing N atoms in the methine chains of the ions. The application of these theories to basic dyes of different classes is considered. W. R. A.

Relation between position of peak of property–composition curves and of the point of maximum deviation from the addition rule. V. J. Anosov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 73—74).—Theoretical. The points in question are not in most cases identical. R. T.

Statistical mechanics of imperfect gases. E. W. Montroll and J. E. Mayer (*J. Chem. Physics*, 1941, **9**, 626—637).—Mathematical. The highly multiple integrals in the statistical mechanical equations for the properties of imperfect gases are expressed in terms of the characteristic terms of the integral equation. The method is applied to the calculation of the third virial coeff. and mol. distribution function at various temp. for imperfect gases with Lennard-Jones potential energy functions. J. W. S.

III.—CRYSTAL STRUCTURE.

Estimation of intensities from *X*-ray films. J. S. Lukesh (*J. Chem. Physics*, 1941, **9**, 659—660).—Prints are taken of the film at various exposure times, and all are developed simultaneously. The exposure time which just produces darkening of a given spot is taken as a measure of the intensity of the diffracted *X*-ray beam producing the spot. J. W. S.

Fourier analysis of crystals and the density of metal electrons. A. Sommerfeld (*Naturwiss.*, 1940, **28**, 769—777).—The method of Fourier analysis is reviewed. Its application to simple examples of ionic, at., and mol. linking is considered in connexion with rock-salt, diamond, and $(CH_2)_6N_4$, respectively. For the investigation of the distribution of free electrons in metals it is necessary to construct a three-dimensional Fourier analysis. Mg is taken as an example. A. J. M.

Internal friction introduced by cold working. C. Zener (*Physical Rev.*, 1941, [ii], **60**, 455—457; cf. A., 1938, 1, 305).—Available experimental data indicate that changes in a cold-worked metal giving rise to internal friction are distinct from changes which give rise to hardening and to the broadening of *X*-ray lines. It is suggested that this internal friction is due to the inability of certain areas on slip planes to maintain shearing stresses. Theoretical consequences are in agreement with experimental data. N. M. B.

Determination of elastic constants of single-crystals with *X*-rays, illustrated with aluminium crystals. F. Günther (*Z. Krist.*, 1941, **103**, 230—273).—Details are given of the construction and operation of an apparatus for the prep. of reflected oscillation *X*-radiograms of elastically deformed single-crystals of metals. The fixed specimen mounting permits application of tension or bending stress, and the conical camera and *X*-ray rube oscillate as one unit about the specimen axis. Typical *X*-radiograms for Al crystals are discussed; increase of elastic deformation causes an increase in the (240) reflexion angles, from which the elastic moduli of the crystal are calc. Complete data for a cubic crystal can be obtained from one *X*-radiogram for the unstressed specimen, and one for the specimen under known stress. Stress also causes a broadening of the reflexions, due to superposed deformations in the lattice, but these are of little val. for quant. measurements. A. J. E. W.

Construction and use of *X*-ray powder cameras.—See A., 1942, I, 27.

Non-Laue maxima in the diffraction of *X*-rays from rock-salt: temperature effect. O. J. Baltzer (*Physical Rev.*, 1941, [ii], **60**, 460—465).—Measurements were made at room and liquid-air temp., with an ionisation chamber and electrometer tube circuit, of the intensity of the non-Laue max. observed when Cu $K\alpha$ *X*-rays are diffracted from a rock-salt crystal. The experimental decrease in intensity at liquid-air temp. is in fair agreement with an expression of the form $(1-e^{-2M})$, where e^{-2M} is the Debye–Waller temp. factor. N. M. B.

Temperature study of *X*-ray diffraction by diamond. (Mrs.) K. Lonsdale and H. Smith (*Physical Rev.*, 1941, [ii], **60**, 617—618; cf. A., 1941, I, 402).—Evidence relating to the " primary " (I) and " secondary " (II) types of diffuse diffraction is summarised. Type II is not really diffuse, but is structure-sensitive and much less temp.-sensitive than I. It appears that only II was observed by Raman (cf. *ibid.*, 365) and only for diamonds which show the effect sharply. Optimum conditions for observing I are given. N. M. B.

Transformation in eutectoid copper–aluminium alloys. V. Crystal structure of the martensite γ' phase.—See A., 1942, I, 17.

Alpha solid solutions of the zinc–silver system. II. Lattice parameters with notes on the ζ phase.—See A., 1942, I, 18.

Crystal structure of monoclinic α-bismuth trioxide. L. G. Sillén (*Z. Krist.*, 1941, **103**, 274—290; cf. A., 1940, I, 349).—The Bi parameters are fully determined by a modification (described in detail) of the Patterson and Harker methods of analysis, from rotation and Weissenberg *X*-radiograms. Probable O positions are deduced by consideration of space-filling and co-ordination. A. J. E. W.

***X*-Ray studies on the hydrous oxides. X. Anatase and rutile modifications of titania.** H. B. Weiser, W. O. Milligan, and E. L. Cook (*J. Physical Chem.*, 1941, **45**, 1227—1234).—The results of *X*-ray diffraction studies on TiO_2 prepared by various methods are described. Anatase (**I**) is the primary product of the hydrolysis of $Ti(NO_3)_4$ and $TiCl_4$ in presence of NO_3' and Cl′ respectively, which are adsorbed and form a protective layer. (**I**) redissolves in presence of a large excess of acid and is pptd. as the less sol. rutile (**II**) modification. Hydrolysis at 100° also increases the rate of change from (**I**) to (**II**). Thus the (**I**)–(**II**) change is retarded by ion adsorption and accelerated by factors which favour dissolution. (**I**) protected by SO_4'' is converted into (**II**) only very slowly even in presence of conc. H_2SO_4. C. R. H.

New twin in oxalic acid dihydrate; structure of this substance. I. Schaacke (*Z. Krist.*, 1941, **103**, 291—296).—When crystallised from conc. HNO_3 at room temp., $H_2C_2O_4,2H_2O$ (**I**) forms contact twins $[(11\bar{1})^S = (110)^E]$ of a rare type, the formation of which is discussed with reference to the structure (Robertson and Woodward, A., 1937, I, 68; Brill *et al.*, A., 1940, I, 62) and general principles of twin formation (cf. A., 1937, I, 234, 350). A change of axes is proposed for the (**I**) structure. A. J. E. W.

Space-group of crystals of *o*-, *m*-, and *p*-nitrobenzoic acids. V. C. Thakar, M. R. Kapadia, and M. Prasad (*J. Indian Chem. Soc.*, 1940, **17**, 555—564).—*o*-, *m*-, and *p*-$NO_2{\cdot}C_6H_4{\cdot}CO_2H$, respectively, have *a* 7·58, 10·41, 12·95; *b* 14·01, 10·69, 5·04; *c* 5·05, 13·22, 21·31 A.; space-groups, C_1^1, C_{2h}^5, C_{2h}^5; 2, 8, 8 mols. per unit cell; $\rho_{obs.}$ 1·559, 1·527, 1·61. In the *m*- and *p*-acid crystals two mols. are associated to form an asymmetric structural unit. Rotation photographs are reproduced, and visually estimated intensities are tabulated. A. J. E. W.

***X*-Ray study of structure of polyvinyl alcohol.** (Miss) R. C. L. Mooney (*J. Amer. Chem. Soc.*, 1941, **63**, 2828—2832).—The structure of polyvinyl alcohol (**I**) has been investigated from *X*-ray fibre diagrams, using Cu *K* radiation filtered through Ni (cf. A., 1936, 17). The reflexions (~30) are indexed with reference to a pseudo-orthorhombic cell having *a* 7·82, *b* 2·52, and *c* 6·60 A. The periodicity along the fibre axis (2·52 A.) indicates a planar zig-zag configuration for the C chains with glycols in the 1 : 3 positions (cf. A., 1938, II, 255). Using the reported density of 1·293 for (**I**) the unit cell contains two chain segments $-CH_2{\cdot}CH(OH)-$ with calc. density of 1·31. The symmetry is C_{2h}^2—$P_{2_1/m}$ with C and O atoms lying in the planes of symmetry. The positions

of these atoms have been found such that calc. and observed intensities are in good agreement. The strucure consists of long chain mols. oriented so that pairs of chains are linked through OH bands. W. R. A.

Electron diffraction studies of thin films. II. Anomalous powder patterns produced by small crystals. L. H. Germer and A. H. White (*Physical Rev.*, 1941, [ii], **60**, 447—454; cf. A., 1939, I, 513).—In electron diffraction patterns produced by very small face-centred cubic crystals the (200) ring shows abnormally weak intensity. This was studied by microphotometer curves for crystals of estimated mean linear dimensions 20—67 A. in Cu films. The intensity ratio of the (200) and (111) rings varied from 0·14 for the 20 A. to 0·42 for the 67 A. crystals, the latter val. agreeing approx. with the theoretical val. 0·48 for large Cu crystals. Calculations are made to determine the scattering from gas mols., assuming for each mol. N similar atoms with a face-centred cubic arrangement. For $N = 55$ no (200) ring can be detected in the pattern, but for $N = 379$ the (200) ring is very plain and all the rings have relative intensities appropriate to large crystals. The anomaly is thus accounted for on the basis of smallness of the individual crystals. N. M. B.

Investigation of thin films of cellulose and its derivatives by electron diffraction. I. The three halos. II. Crystalline patterns. J. Kakinoki (*Proc. Phys. Math. Soc. Japan*, 1940, **22**, 1010—1016, 1017—1022; *Rev. Phys. Chem. Japan*, 1941, **15**, 135).—I. The experiments on thin films of nitrocellulose previously reported (cf. A., 1940, I, 287) have been extended to films of native cellulose (**I**), acetyl-, benzyl-, and methyl-cellulose, and agar, gelatin, and polystyrene, with similar results.

II. The cryst. patterns obtained by electron diffraction are consistent with those obtained by X-rays. The alternative crystal structures for (**I**) are discussed. Comparison between the cryst. rings and the amorphous three halos is made. C. R. H.

Magnetic rotatory power of crystalline nickel sulphate in the ultra-violet region. J. J. O'Connor, C. Beck, and N. Underwood (*Physical Rev.*, 1941, [ii], **60**, 443—447).—Using a modified improved method (cf. Ingersoll, A., 1940, I, 350), previous measurements in the visible (cf. Slack, A., 1938, I, 563) were extended as far as the ultra-violet 2537 A. line of Hg. An unsymmetrical anomaly was found at the strong 3850 A. absorption band. The consts. of the magnetic rotatory dispersion equation are evaluated so that Verdet consts. calc. from the equation agree with the experimental vals. throughout the visible and ultra-violet except within the 3850 A. absorption band. N. M. B.

Electrical resistance of graphite. T. Wada (*J. Electrochem. Assoc. Japan*, 1940, **8**, 200—204; *Rev. Phys. Chem. Japan*, 1941, **15**, 134).—The electrical resistance of graphite is influenced by moisture and volatile matter in proportion to their amounts. Flake graphite of low resistance has a correspondingly high bulk compressibility. C. R. H.

Conical refraction in naphthalene crystals. (Sir) C. V. Raman, V. S. Rajagopalan, and T. M. K. Nedungadi (*Proc. Indian Acad. Sci.*, 1941, **A**, **14**, 221—227).—The angles of internal and external conical refraction for $C_{10}H_8$ are exceptionally large. The so-called Poggendorff dark circle appears only in internal refraction and is an ultra-focal phenomenon. External refraction is converse to the Poggendorff phenomenon and results from a concn. of energy at the conical point of the wave-surface and along the axis of single-ray velocity. When the microscope is focussed on the second surface of the crystal and not on the source of light, the field of view exhibits a picture of the wave-surface in two sheets, their intersection appearing as an intensely luminous point and the tangent plane to the surface as a dark ring. W. R. A.

Unstable forms of the solid state. A. V. Nikolaev (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 109—134).—It is concluded from a study of heating curves of numerous minerals, salts, and org. substances that solids may be classified as amorphous, vitreous, and cryst., the d and stability increasing, and the free energy diminishing, in the order given. R. T.

Theory of relaxation of metals.—See A., 1942, I, 52.

Rigidity modulus of β-brass single crystals. W. A. Good (*Physical Rev.*, 1941, [ii], **60**, 605—609; cf. Rinehart, A., 1941, I, 198).—Measurements for 10 crystals as a function of crystal orientation and temp. from 25° to 500° by the method of the composite piezoelectric oscillator are reported. The relation of moduli G' (bending + twisting) and G (twisting only) is discussed (cf. Brown, *ibid.*, 77). The principal elastic parameters are tabulated and plotted as functions of temp. Directions of crystal and max. and min. vals. of the rigidity modulus at room and crit. temp. are given. The elastic anisotropy is 12·8 at room temp., decreases to 12·3 at 250°, and is 13·0 at the crit. temp. The large bending–torsion effect agrees with theory. N. M. B.

Theory of the plastic properties of solids. IV. F. Seitz and T. A. Read (*J. Appl. Physics*, 1941, **12**, 538—554).—The plastic properties of polycrystals and some properties of both single and poly-crystals are discussed. O. D. S.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES

High-temperature magnetisation of ferrite. T. Takei, I. Yasuda, and S. Ishihara (*J. Electrochem. Assoc. Japan*, 1939, **59**, 568—571; *Rev. Phys. Chem. Japan*, 1941, **15**, 128).—The high-temp. magnetisation of CuO,Fe_2O_3 and CoO,Fe_2O_3 has been investigated. In substances susceptible to such treatment the formation of a superlattice is quite noticeable. High-temp. magnetisation tends to accelerate the half-turn of the elemental magnets. C. R. H.

Mechanism of polymerisation of thiocyanogen from the magnetic viewpoint. S. S. Bhatnagar, P. L. Kapur, and B. D. Khosla (*J. Indian Chem. Soc.*, 1940, **17**, 529—536).—χ data for solutions of $(CNS)_2$ in CS_2 (0·39—0·48 N.), $CHBr_3$ (0·25—0·33 N.), and *cyclo*hexane (**I**) (0·02—0·03 N.) at 18—20° are recorded. Fresh CS_2 and $CHBr_3$ solutions are yellow and contain a diamagnetic solute, but on keeping for 24 hr. the CS_2 solutions deposit orange polymeric "para-$(CNS)_2$" (**II**) and the residual solute becomes paramagnetic. The (**I**) solutions are red and contain a paramagnetic solute. Specimens of (**II**) obtained from the various solutions on keeping are identical (d 1·758, χ $3{\cdot}36 \times 10^{-7}$). The results confirm the existence of a tautomeric equilibrium between NCS·SCN (predominant) and S:S(CN)$_2$ (cf. Kaufmann and Kögler, A., 1926, 369) in $CHBr_3$ and CS_2, with 0·4—0·5% of free CNS in dil. CS_2 solutions. The (**I**) solutions contain 7—10% of free CNS. Polymerisation proceeds thus: $CNS \rightarrow (CNS)_2 \rightarrow (CNS)_3$ . . ., not exclusively through "even" mols., and the process probably involves breaking of one of the C–N linkings. A. J. E. W.

Magnetic increase of resistance and conductivity types in metals. E. Justi [with J. Kramer, H. Scheffers, and R. Schulze] (*Physikal. Z.*, 1940, **41**, 563—570).—Mainly a review of previous work. The inability of the free electron gas theory to account for galvanomagnetic phenomena is indicated, and a "type theory" of metallic conduction, involving collision and linking anisotropy in the metal lattice, is discussed. The limits of applicability of Kohler's rule (A., 1938, I, 302) are examined, and the use of "reduced Kohler diagrams" (cf. A., 1942, I, 13) is discussed; these diagrams permit a correlation between the conductivity mechanism in a metallic element and its position in the periodic system. A. J. E. W.

Magnetic susceptibility and optical rotatory powers of *p*-hydroxy-α-naphthyliminocamphor.—See A., 1942, II, 60.

Magnetic studies of co-ordination compounds. Binuclear copper derivatives of diphenylmethylarsine.—See A., 1942, II, 67.

Deviations from Ohm's law in soda-lime glass. R. J. Maurer (*J. Chem. Physics*, 1941, **9**, 579—584).—Measurements at 0—110° indicate that the deviation of the conductivity of soda-lime glass from Ohm's law is correctly described by the theory of electrolytic conductivity up to field-strengths of 7×10^5 v. per cm. Reasonable vals. for the physical consts. which determine the abs. vals. of the c.d. and its variation with field-strength and temp. are deduced from the results. J. W. S.

Sound-wave pressure in liquids and gases in relation to the equation of state. G. Hertz (*Physikal. Z.*, 1940, **41**, 546—549; cf. A., 1940, I, 201).—The Rayleigh and Langevin types of sound-wave pressure are distinguished. The p variation along a wave-train and in a standing wave is examined for an

elastic liquid and a fluid in which changes of state occur adiabatically or according to Boyle's law. Pressure development against a surface is also considered. A. J. E. W.

Collision excitation of intramolecular vibrations in gases and gas mixtures. VI. Measurement of sound absorption and dispersion in methane and carbonyl sulphide and their mixtures with other gases. A. Eucken and S. Aybar. **VII. Theory of sound dispersion in the presence of several normal vibrations.** K. Schäfer (*Z. physikal. Chem.*, 1940, **B**, **46**, 195—211, 212—228; cf. A., 1938, I, 607).—VI. Dispersion curves of ultrasonic waves in CH_4 and COS have been determined at 302° and 109°, respectively. The curve in each case is smooth and corresponds with a single val. of the relaxation time, β, characteristic of the establishment of equilibrium between the translational and vibrational energies of the mol. Absorption of ultra-sound in CH_4 and COS and in their mixtures with various concns. of H_2, CO_2, N_2, A, O_2, CO, and He has been measured at various pressures. Vals. of β or of β_{BA}, the relaxation time characteristic of the deactivation of the excited mol. A, COS or CH_4, by the added gas B are calc. In every case a single val. of β or β_{BA} is sufficient for the interpretation of the data. For CH_4 and COS resonance between the two vibrational degrees of freedom operative in absorption at these temp. is impossible and the explanation advanced for similar single vals. of β and β_{BA} for CO_2 and N_2O (cf. Eucken and Küchler, A., 1939, I, 128) is not applicable. It is suggested that the energy of translation is transferred selectively to one vibrational degree of freedom and that equilibrium between the two vibrational degrees of freedom is established in a time which is short compared with β. The most effective foreign gases for deactivation are those with which chemical reaction of the excited mol. may occur. He is relatively active, probably on account of its small size, which allows deep penetration into the mol.

VII. The theory of sound dispersion by mols. with several effective vibrational degrees of freedom is developed. The dispersion curves obtained are closely similar to those previously calc. for mols. with one operative degree of vibrational freedom. The ratio of the relaxation times characteristic of the various modes of vibration may be calc. from the observed small deviations from the simple dispersion curve. This calculation is carried out for COS at 109° (cf. VI above). Observed abnormal temp. coeffs. of β are interpreted by the theory. O. D. S.

Diminished acoustic velocity in fluids at high frequencies. B. V. R. Rao and D. S. S. Ramaiya (*Physical Rev.*, 1941, [ii], **60**, 615).—In the dispersion of acoustic velocity in $COMe_2$ in the hypersonic region, the ultrasonic velocity is anomalously > the hypersonic velocity (cf. A., 1938, 302). This is explained by the departure from adiabatic of the pressure changes in the medium at high frequencies and the enhancement of heat conduction. N. M. B.

Intrinsic brightness of the positive crater of a pure carbon arc; sublimation temperature of carbon. W. Finkelnburg [with H. Schluge] (*Physikal. Z.*, 1940, **41**, 559—563).—The intrinsic brightness (b Hefner c.p. per sq. cm.) of the positive crater increases linearly with the arc current up to ~18,000; hissing generally commences at this point, but b can occasionally be followed up to 25,000. A reproducible b val. of 18,500 is obtained with graphite electrodes just before hissing commences. The temp. of the crater (~4000° K. at b = 18,500) is variable and ≪ the sublimation temp. of C. A. J. E. W.

Atomic weight and specific heat. V. F. V. Guardia (*Bol. Soc. Quim., Peru*, 1941, **7**, 165—173).—The val. of the expression $(A + Z)/Z = S_e$, interrelating at. wt. (A) and at. no. (Z), is ~3·3. Hence, as the sp. heat (c) is related to the at. wt. by $Ac = C_a = 6{\cdot}6$; it follows that $c_e = 2S_e/A$. F. R. G.

Heat capacities of cobalt hexammine halides. W. T. Ziegler (*J. Amer. Chem. Soc.*, 1941, **63**, 2700—2703).—Vals. of C_p have been determined calorimetrically from 107° to 321° K. for $Co(NH_3)_6I_2$, $Co(NH_3)_6I_3$, and $Co(NH_3)_6Cl_3$. $Co(NH_3)_6I_3$ exhibits anomalous vals. of C_p in the range 270—290° K. with max. at 277·4±0·5° K. This is attributed to thermal motion of NH_3 mols. about their Co–N bonds. W. R. A.

Rotation in ionic lattices. Heat capacities of sodium and potassium cyanides. C. E. Messer and W. T. Ziegler (*J. Amer. Chem. Soc.*, 1941, **63**, 2703—2708).—Vals. of C_p have been determined calorimetrically from 100° to 345° K. for NaCN and KCN. Both show regions of anomalous vals. of C_p, NaCN having two max. at 172·1±0·5° and 288·5±0·3° K., and KCN one max. at 168·3±0·4° K. The heats of "transitions" have been computed. C_p is regarded as the sum of terms due to the lattice (C_L), rotational motion of groups (C_R), expansion ($C_p - C_v$), and (for NaCN and KCN negligibly small) internal vibration of groups ($C_{vib.}$); vals. for these have been deduced. The magnitude of C_R and its variation with temp. are discussed. The transition of NaCN at 172° K. may be a transformation from order to disorder in the orientations of the mols. W. R. A.

Specific heats at low temperatures of ferrous, manganous, and zirconium silicates. K. K. Kelley (*J. Amer. Chem. Soc.*, 1941, **63**, 2750—2752).—Vals. of C_p from 52° to 295° K. have been measured for Fe_2SiO_4, $MnSiO_3$, and $ZrSiO_4$; Fe_2SiO_4 yields a C_p curve with a pronounced peak at 65·0° K. The entropies at 298·16° K. are: Fe_2SiO_4 35·4±1·4; $MnSiO_3$ 21·3±0·3; $ZrSiO_4$ 20·1±0·3. $\Delta G_{298\cdot16°\,K.}$ vals. are: $MnSiO_3$ −282,100; Fe_2SiO_4 −324,800 g.-cal. W. R. A.

Heat capacity, heats of fusion and vaporisation, vapour pressure, and entropy of arsenic trifluoride. H. Russell, jun., R. E. Rundle, and D. M. Yost (*J. Amer. Chem. Soc.*, 1941, **63**, 2825—2828).—Vals. of C_p of AsF_3 have been determined calorimetrically from 13° to 288° K. V.p. measurements from 265° to 292° K. (pressures 28—140 mm. Hg) fit the equation $\log_{10} p_{(mm.)} = 61{\cdot}3797 - 4149{\cdot}78/T - 18{\cdot}2640 \log_{10} T$. The m.p. is 267·21±0·02° K. and heats of fusion and vaporisation (at 292·5° K. and 142·6 mm.) are 2486 and 8566 g.-cal. per mol., respectively. Vals. of entropy from calorimetric and spectroscopic data are 72·09±0·15 (at 141·6 mm. and 292·50° K.) and 72·12±0·10 (at 1 atm. and 298·16° K.) g.-cal. per degree per mol., respectively. When solid AsF_3 is heated or cooled "cracking noises were heard" and at temp. of liquid air these noises were accompanied by strong luminescence. Since no temp. effect was observable this behaviour is considered to arise from static discharges and not from a change of phase. W. R. A.

Physical constants of the normal paraffin hydrocarbons. R. M. Deanesly and L. T. Carleton (*J. Physical Chem.*, 1941, **45**, 1104—1123).—The f.p., b.p., d_4^{20}, n_D^{20}, and temp. coeffs. of the last two properties have been obtained for highly purified n-$C_{12}H_{26}$ and n-$C_{16}H_{34}$. These vals. have been used as reference points in deriving relations connecting physical properties with the no. of C in the C_5—C_{18} series of n-paraffins. All available data have been surveyed and "best" vals. are tabulated. C. R. H.

Vapour pressure and heat of vaporisation of $^{15}N_2$. I. Kirshenbaum (*J. Chem. Physics*, 1941, **9**, 660).—The difference in v.p. between ordinary N_2 and N_2 containing 34·6% of ^{15}N, with the equilibrium proportions of $^{14}N_2$, $^{15}N_2$, and $^{14}N^{15}N$, has been investigated at 64—74° K. The results indicate that the latent heat of vaporisation of pure $^{15}N_2$ would be 3·27 g.-cal. > that of ordinary N_2. J. W. S.

Thermal expansion of pure metals: copper, gold, aluminium, nickel, and iron. F. C. Nix and D. MacNair (*Physical Rev.*, 1941, [ii], **60**, 597—605).—High-precision data for linear thermal expansions determined interferometrically are tabulated in full from −196° to ~400° for Al and to 700° for Fe, Ni, Cu, and Au. The relation between true thermal coeff. of expansion and temp. conforms well with the Grueneisen–Debye theory when vals. are chosen for the Debye characteristic temp. which are found to agree with those chosen to accord with the Debye theory of sp. heats. The characteristic temp. vals. are: Ni 410°, Fe 420°, Al 400°, Cu 325°, and Au 190 °K. The magnetic Curie temp. for Ni is 352°. N. M. B.

Viscosity–temperature function of liquids. A. H. Nissan (*Phil. Mag.*, 1941, [vii], **32**, 441—456; cf. A., 1940, I, 289).—The curve representing the variation of viscosity η of the normal paraffins with the reduced temp. T/T_b, where T is the abs. temp. of measurement and T_b the abs. b.p., is closely fitted by the equation: $\log \eta = 6{\cdot}283 - 18{\cdot}572T/T_b + 17{\cdot}505(T/T_b)^2 - 5{\cdot}900(T/T_b)^3$. It is shown by a graphical method that for > 100 org. and inorg. liquids η varies with T/T_b according to a similar equation: $\log \eta = A - B[18{\cdot}572T/T_b - 17{\cdot}505(T/T_b)^2 + 5{\cdot}9(T/T_b)^3]$, where A and B are consts. characteristic of the liquid. Liquid He is the only investigated liquid for which the equation does not hold.

The physical significance of the equation is discussed and it is emphasised that it contains a term representing an increase in η with T, such as is observed for gases. O. D. S.

Viscosity function. III. Complete viscosity range. E. P. Irany (*J. Amer. Chem. Soc.*, 1941, **63**, 2611—2617; cf. A., 1939, I, 462).—Vals. of η of poly*iso*butylene, paraffinic and naphthenic oils, ligroin, C_6H_6, C_7H_{16}, and kerosene have been measured from 0° to 40°. Three viscosity scales, ideal mixture (Φ), ideal temp. (Θ), and ideal pressure (Π), have been derived. Φ and Θ are continuous and unique from 0·1 to 5000 centipoises and although not identical (cf. A., 1938, I, 610), have been related quantitatively. Π is extended to 10,000 centipoises. Φ, Θ, and Π have been joined into continuity. A fictitious "ideal liquid" capable of passing through all conceivable variations of the liquid state without limitation is defined by use of the viscosity scales, which are considered to provide the most extensive empirical evidence to test the validity of mathematical formulations of η functions. W. R. A.

Physical aspects of boundary lubrication. O. Beeck (*J. Appl. Physics*, 1941, **12**, 512—518).—A summary of recent work on the phenomena of friction and wear between metals under conditions of lubrication such that no fluid film of lubricant exists between the moving surfaces. O. D. S.

Frictional phenomena. I. A. Gemant (*J. Appl. Physics*, 1941, **12**, 530—537).—Introductory to a series of articles on frictional phenomena in solids, gases, and liquids. The mathematical theory of viscous flow is discussed. O. D. S.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Transport cross-sections of monatomic gas mixtures. G. M. Roe (*Physical Rev.*, 1941, [ii], **60**, 468—469; cf. Jones, A., 1940, I, 389).—Mathematical. A more general treatment of the integrals involved in the Chapman–Enskog form of the coeffs. of η, diffusion, and thermal conduction and diffusion. N. M. B.

Mobility of protons in an electric field in the α-phase of the system palladium–hydrogen.—See A., 1942, I, 31.

Stefan's law. Morphology of liquids. K. L. Wolf and K. Klaproth (*Z. physikal. Chem.*, 1940, **B**, **46**, 276—286).—It is shown that the ratio of internal heat of vaporisation, λ_i, to total mol. surface energy, Σ_M, for binary liquid mixtures, which depends on the type of packing of the mols., is also connected with the ratio of the vols. occupied by the mols. of the two species. Stefan's law, stating that $\phi = \lambda_i/\Sigma_M = 2$, can also be put in the form $\phi = Z/(Z - X)$, where Z is the no. of mols. surrounding a mol. in the interior of the liquid (co-ordination no.) and X is the no. of mols. surrounding a mol. in the surface. The max. deviations, Δ_ϕ, from the mixture rule are obtained for a large no. of binary mixtures. These deviations are particularly small for $Z = 12$. The "radii-quotients" $(V_{M_1}/V_{M_2})^{\frac{1}{3}}$ for binary mixtures, where V_{M_1} and V_{M_2} are the vols. occupied by mols. of the two species, play a similar part to the quotients of the radii of ions in the problem of isomorphism of crystals. A. J. M.

Clusius separation process in liquids. J. W. Hiby and K. Wirtz (*Physikal. Z.*, 1940, **41**, 77—82).—Expressions based on the Debye theory (cf. A., 1940, I, 135) are derived for the degree of sedimentation of a dil. solution in a Clusius thermal diffusion column with upper and lower reservoirs having vols. $\gg$ that of the diffusion space. The ratio of the concns. in these reservoirs increases linearly with time and with the Soret coeff. (D'/D) for the solution. The selective sedimentation of solutes giving different D'/D vals., and the practicability of separation by successive stages, are considered. Approx. relative vals. of D'/D for aq. solutions of alkali halides and sulphates, $CaCl_2$, and $ZnSO_4$ are recorded. A. J. E. W.

Additivity of specific weight and specific volume. V. J. Anosov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 71—72).—Theoretical. When no vol. change takes place on mixing the components of a system the sp. vol. follows the addition rule when the composition is expressed as parts by wt.; the same applies to sp. wt. when composition is expressed as parts by vol. R. T.

Apparent molal volumes of electrolyte mixtures in aqueous solution. A. S. Chakravarti and B. Prasad (*J. Indian Chem. Soc.*, 1941, **18**, 239—244).—Apparent mol. vols. (ϕ) of the mixtures K_2SO_4 + KCl, $NaNO_3$ + NaCl, $NaNO_3$ + KCl, and $NaNO_3$ + HCl were determined in aq. solution at 35°, for three different compositions in each case, the total concn. being varied. The results show that the behaviour of the mixture is represented by the relation $\phi = \phi_0 + k\sqrt{c}$ within the same limitations as for a single electrolyte, when the average mol. wt. is calc. by the mixture rule. The consts. ϕ_0 and k are, however, linear functions of the composition (mol.-% of any one component) in the case of mixtures. F. L. U.

Partial molal volumes of potassium salts of the Hofmeister series. M. E. Halasey (*J. Physical Chem.*, 1941, **45**, 1252—1263).—From d and sp. vol. data obtained for solutions of KCl, KBr, KI, KNO_3, and KCNS over the range 5—30° at 2·5° intervals and at concns. 0·005—0·5M., the vals. of the consts. a and b in the equations $\phi = a + bm^{0·5}$ and $\bar{v}_1 = a + 1·5bm^{0·5}$ have been calc. (m = molality, ϕ = apparent mol. vol., $\bar{v}_1$ = partial mol. vol. of the salt). Similar vals. have been obtained for K_2SO_4, K citrate, and K tartrate at a few temp. In order of decreasing change in vol. with change in concn. of solution the salts range themselves in the series citrate > K_2SO_4 > KCNS > tartrate > KCl > KNO_3 > KBr > KI. The data are compared with those of other investigators. C. R. H.

Physical properties of sodium, potassium, and ammonium lactate solutions. A. A. Dietz, E. F. Degering, and H. H. Schopmeyer (*Ind. Eng. Chem.*, 1941, **33**, 1444—1447).—Measurements of d^{25}, η^{25}, n^{25}, surface tension (σ) at 29°, b.p., and f.p. of aq. solutions of Na, K, and NH_4 lactate over a wide range of concns. are recorded in graphical and tabular form. The σ data show some abnormalities. Conc. solutions (>30%) of NH_4 lactate have very low vals. of σ compared with the Na and K lactate solutions. C. R. H.

Viscosity of aqueous solutions of mixtures of sodium chloride with magnesium chloride and of sodium chloride with barium chloride. E. Asmus (*Z. physikal. Chem.*, 1940, **B**, **47**, 357—364).—The η vals. determined by Chacravarti and Prasad (A., 1940, I, 203) are considered from the point of view of the theory of Onsager and Fuoss. For NaCl–$MgCl_2$ agreement between theory and experiment is good over the entire range, for NaCl–$BaCl_2$ only in mixtures with >50% of NaCl. F. L. U.

Viscosity of aqueous solutions of mixed strong electrolytes in which one component is at constant concentration. E. Asmus (*Z. physikal. Chem.*, 1940, **B**, **47**, 365—385; cf. preceding abstract).—It is shown that the η–concn. relation used by Chacravarti and Prasad (cf. A., 1940, I, 203) for mixtures of strong electrolytes can be valid only over a restricted range of concn., and then only as a first approximation. The effect of slight impurities in the H_2O used as solvent on measurements of η is discussed. F. L. U.

Thermal diffusion of binary salt solutions. K. Hirota (*Bull. Chem. Soc. Japan*, 1941, **16**, 232—234).—Experiments similar to and confirming those reported by Gillespie and Breck (cf. A., 1941, I, 250) are described. C. R. H.

B.p. elevation of sucrose solutions. C. J. Tressler, W. I. Zimmerman, and C. O. Willits (*J. Physical Chem.*, 1941, **45**, 1242—1245).—The elevation of the b.p. of sucrose solutions (0—71·9%) has been determined and compared with previously published data. The present vals. are < earlier vals. C. R. H.

Ternary system *m*-phenylenediamine–benzoic acid–salicylic acid. N. S. Kurnakov and E. B. Schternina (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 135—163).—The composition–conductivity and $-\eta$ curves of the systems *m*-$C_6H_4(NH_2)_2$–BzOH and –salicylic acid (I), and BzOH–(I), at 90°, 100°, and 125° confirm fusion curve evidence of formation of 1 : 1 compounds in all the systems. Composition–property diagrams based on these curves are presented for the ternary system, at 90°, 100°, and 125°. R. T.

Viscosity in the ternary system K_2O–P_2O_5–H_2O. M. I. Ravitsch (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 331—353).—Composition–d and $-\eta$ curves are recorded for the system, at 0°, 15°, 20°, 25°, 30°, and 35°. The curves in general resemble the corresponding solubility curves. R. T.

Theory of relaxation of metals. S. I. Gubkin and V. I. Kutaitzev (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 257—

262).—The effect on the structure of alloys of applying deforming stresses varies, according to whether the temp. reached is high enough to render recrystallisation possible. R. T.

Phases of variable composition in the system Pb–Na. N. S. Kurnakov, S. A. Pogodin, E. S. Schpitschinetzki, and V. S. Zorin (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 233—250).—The solid solubility of Na in Pb rises from 5 at.-% at 20° to 13·3 at.-% at 290°. The hardest alloy is that containing 1·5% of Na. A study of hardness, m.p., and crystal structure of annealed and rapidly cooled alloys containing up to 50% of Na indicates that the only compound formed is NaPb. R. T.

Solid solutions of sodium in lead. N. V. Ageev and N. J. Talizin (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 251—255).—The solid solubility of Na in Pb rises from 0·45% at room temp. to 1·37% at 290°. R. T.

Copper–zirconium alloys. S. A. Pogodin and I. S. Schumova (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 225—232).—Alloys containing 0—40% of Zr have been studied. The *compound* Cu_3Zr, m.p. 1140°, is suggested by the fusion diagram. The solubility of Zr in solid Cu rises from 0·03% at 300° to 0·9% at 925°. The hardness of the alloys rises with increasing Zr content; it rises after 6 hr. at 300°, but falls considerably after a further 480 hr. at 300°. R. T.

Structure of the β phase of copper–antimony alloys. N. V. Ageev and E. S. Makarov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 171—176).—The findings of Murakami *et al.* (A., 1937, I, 176) and of Jones and Evans (A., 1928, 6) are confirmed, with minor differences. R. T.

Conductivity and hardness of manganese–copper alloys. (A) S. F. Shemtschushni and V. K. Petraschevitsch. (B) S. A. Pogodin (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 387—395, 397—405).—(A) A reprint (cf. *Bull. Russ. Acad. Sci.*, 1917, 863).

(B) More recent advances are reviewed. R. T.

Structure of β phase of gold–zinc alloys. N. V. Ageev and D. N. Schoichet (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 165—170).—The β phase consists basically of the compound AuZn, and is homogeneous within the limits 47·5—53 at.-% of Au. The orderliness of the structure of the alloy falls with increasing deviation from the composition AuZn. R. T.

(A) Properties of solid solutions of magnesium and aluminium in the system Al–Mg. (B) Transformations in the middle part of the system Al–Mg. N. S. Kurnakov and V. I. Micheeva (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 201—208, 209—224).—(A) Solubility data recorded for Mg in Al and for Al in Mg, at 20—420°, are substantially in agreement with previous findings (cf. Hanson and Gayler, B., 1921, 13). The modifications in the hardness, *X*-ray spectrum, and lattice consts. of the solid solutions caused by subjecting them to thermal treatment are explained on the basis of formation or dissociation of Al_3Mg_4, which is stable at room temp.

(B) Micro-structure, conductivity, thermochemical, and *X*-ray spectrum data are recorded for alloys containing 36—50% of Mg. Three phases, β (Mg 35·5—37·5%), β′ (Mg 41—42%), and γ phase (Mg 49·5—57%), are distinguished at 0—460°. The β′ phase readily breaks down into β and γ phase when cooled slowly from temp. > 370°. It may be stabilised by addition of 1—2% of Zn; Cu has no effect on its stability. R. T.

(A) *X*-Ray study of ternary solid solutions of magnesium and silicon in aluminium. (B) *X*-Ray study of ageing of aluminium–magnesium–silicon alloys. V. G. Kuznetzov and E. S. Makarov (*Ann. Sect. Anal. Phys. Chim.*, 1940, **13**, 177—190, 191—200; cf. A., 1940, I, 251).—(A) The space lattice of alloys containing ≯2·2% of Mg + Si is identical with that of Al in the case of alloys cooled rapidly from 550°. The *X*-ray spectrum of annealed alloys exhibits faint lines due to Mg_2Si.

(B) Breakdown of the solid solution with modification of lattice consts. in the direction of pure Al, caused by artificial ageing, is not observed in the case of alloys containing > 2 atoms of Mg per Si atom. In alloys containing 1·2% of Mg + Si the velocity and the magnitude of the process of deformation of the space lattice of the solid solutions during annealing increase rapidly as the at. ratio Mg : Si exceeds 1 : 1. The process of ageing is greatly accelerated when the alloys are subjected to deforming stresses. R. T.

Nomograph for the solubility of sulphur dioxide in water. Correction. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 1376).—A revised nomograph, which corrects errors in the original (cf. A., 1941, I, 372), has been constructed. C. R. H.

Nomographs for the solubilities of hydrogen and nitrogen in liquid ammonia. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 1454—1455).—Nomographs connecting pressure, temp., and solubility have been constructed. C. R. H.

Solubilities of hydrogen chloride and hydrogen bromide in carbon tetrachloride and chloroform. J. J. Howland, jun., D. R. Miller, and J. E. Willard (*J. Amer. Chem. Soc.*, 1941, **63**, 2807—2811).—The solubilities of HCl and HBr in $CHCl_3$ and in CCl_4 have been determined at 0°, 15°, and 25° at pressures <1 atm. The solubilities ∝ the partial pressure of the solute. All the solutions show positive deviation from Raoult's law. The results of Hamai (A., 1935, 441) are too low. A solubility apparatus is described. W. R. A.

Solubility of lithium in its melted chloride. S. Karpatschev and E. Jordan (*J. Phys. Chem. Russ.*, 1940, **14**, 1495—1497).—The relationship between the potential E of a C electrode and the concn. c of Li dissolved in a liquid salt is given by $E = \text{const.} - (RT/F)\log_e c$. It is shown experimentally that Li dissolved in melted salts exists in its at. form or as the complex ion Li_2^+. E. AD.

Solubility of solid benzene in several non-polar liquids. R. Negishi (*Rev. Phys. Chem. Japan*, 1941, **15**, 98—116).—In order to test the validity of Hildebrand's equation (cf. A., 1934, 146) the solubility or lowering of the f.p. of solid C_6H_6 in CCl_4, CS_2, $CHCl_3$, and PhMe has been determined. C_6H_6–CCl_4 and C_6H_6–PhMe systems conform well to the equation. For C_6H_6–$CHCl_3$ systems the solubility curve lies above the ideal curve. Considerable deviations are observed in the C_6H_6–CS_2 system and in the system C_6H_6–*cyclo*hexane, which has been examined on the basis of published data. The data are discussed with reference to derived equations for ideal solubilities and mol. heat capacities. C. R. H.

Hydrogen bonds involving the C–H linking. XIV. Solubility of donor solutes in hydrogen-bonding solvents. C. S. Marvel, J. Harkema, and M. J. Copley (*J. Amer. Chem. Soc.*, 1941, **63**, 1609; cf. A., 1941, I, 108).—$CH{:}CPh$, PhSH, $MeNO_2$, $CH{:}C{\cdot}CMe_2{\cdot}OH$, and pyrrole are good solvents for donor mols. of high mol. wt. (polymethyl methacrylate and vinyl ketone, and "Vinylite"), but $CH{:}C{\cdot}CH_2Bu^{\alpha}$ and NHMeAc are poor solvents. Pyrrole is an unusually good solvent for cellulose triacetate. R. S. C.

Formation of a gas layer on a silver surface. A. G. Emslie (*Physical Rev.*, 1941, [ii], **60**, 458—460).—The results of Farnsworth (cf. A., 1941, I, 139) on the change with time of the photo-electric work function of a freshly deposited Ag surface are interpreted in terms of the adsorption of a gas layer and indicate that the adsorbed particles form a mobile mol. film. The variation in the adsorption rate, deduced from the experimental data, agrees with Langmuir's theory of odd and even phases of the adsorbed particles. The surface mobility of the mols., estimated from the theory, shows that the average time spent by a mol. before moving to an adjacent adsorption site is ~30 min. A large fraction of the incident mols. is reflected. N. M. B.

Adsorption at water–air and water–organic liquid interfaces. F. E. Bartell and J. K. Davis (*J. Physical Chem.*, 1941, **45**, 1321—1336).—The effectiveness of EtOH, $Pr^{\alpha}OH$, and $Bu^{\alpha}OH$ in lowering the boundary tension at H_2O–air, –*n*-C_7H_{16}, –C_6H_6, and –$COMe{\cdot}C_5H_{11}$-*n* interfaces has been determined by the pendent drop method. The effect of each alcohol on the tension at the H_2O–*n*-C_7H_{16} interface is almost identical with that at the H_2O–air interface. They are less effective in lowering the tension at H_2O–C_6H_6 and even less so at H_2O–$COMe{\cdot}C_5H_{11}$-*n* interfaces. It is shown that the max. free surface energy available at an interface is a major factor in determining the extent of adsorption at that interface. C. R. H.

Use of small glass spheres in adsorption from non-aqueous media. I. Adsorption of iodine from carbon tetrachloride. A. J. Urbanic and V. R. Damerell (*J. Physical Chem.*, 1941, **45**, 1245—1251).—Glass powder passed through a flame causes the glass to fuse into small spheres. By fractional sedimentation 6·901 g. of spheres 40—80 μ. in diameter

were obtained and introduced into a CCl_4 solution of I. Adsorption of I on the surface of the spheres (2870 sq. cm.) was equiv. to a unimol. layer covering 39·2% of the total glass surface. C. R. H.

Adsorption. I. Effect of heat-treatment on low-temperature adsorption of nitrogen by aluminium oxide. K. A. Krieger (*J. Amer. Chem. Soc.*, 1941, **63**, 2712—2714).—The effect of varying temp. of evacuation from 210° to 938° on the surface area A of Al_2O_3 and on the average heat of adsorption Q of N_2 in the first layer on Al_2O_3 has been investigated. Up to 528° A and Q are approx. const., but increasing temp. reduces A and increases Q. Tentative explanations are advanced. W. R. A.

Adsorption of electrolytes by silicic acid, sesquioxides, and their mixed gels.—See B., 1941, III, 311.

Adsorption of polybasic organic and inorganic acids. Discontinuities in adsorption process from solutions of sugar charcoal. K. D. Jain and J. B. Jha (*J. Indian Chem. Soc.*, 1941, **18**, 321—325; cf. A., 1941, I, 255).—H_3PO_4, H_2SO_4, fumaric, maleic, and chromic acids all give well-defined periodic zigzag adsorption curves. D. F. R.

Sorption of micro-heterogeneous systems by cotton fibre. S. S. Vojutzki, R. E. Prokurat, and E. M. Dzjadel (*Kolloid. Shurn.*, 1940, **6**, 787—804).—Emulsions of smoked sheet rubber stabilised by Na oleate and containing an antioxidising agent ("neozone") have been prepared. The threshold of their coagulation by AcOH depends on the concn. and the dispersity of the emulsions. Glass wool does not adsorb rubber. The apparent adsorption of rubber (calc. as if no H_2O were adsorbed) by cotton wool reached its limiting val. x (*e.g.*, 17 g. per 100 g. of air-dry cotton) in 15 min. Change of temp. (15—45°) did not affect x. x showed a max. for 7% emulsions and increased with acidity (p_H 7·7—10·4) and the degree of dispersity of the emulsion. A pretreatment of cotton by 3% NaOH reduced x, a pretreatment with 3% HCl, and especially with 3% $Al_2(SO_4)_3$, increased it. Microscopical examination showed that adsorption consisted in sticking of slightly deformed rubber particles to fibres; no coating of fibres took place. This process is a case of "heterocoagulation." J. J. B.

Rapid formation of gas bubbles in liquids. W. G. Eversole, G. H. Wagner, and E. Stackhouse (*Ind. Eng. Chem.*, 1941, **33**, 1459—1462).—Experiments carried out with submerged orifices (radius 0·0069—0·017 cm.) and at various gas flow rates (0·125—0·7 c.c. per sec.) show that bubble frequency in pure liquids is almost independent of the rate of flow, the properties of the liquid, and capillary size. Bubble vol. ∝ rate of flow. In EtOH–H_2O mixtures bubble frequency is higher and is more dependent on the rate of flow. Photographs which are reproduced show that liquids of low surface tension cause the bubbles to flatten. C. R. H.

Changes in pressure of unimolecular films of stearic acid due to added drops of benzene. E. R. Washburn, L. F. Transue, and T. J. Thompson (*J. Amer. Chem. Soc.*, 1941, **63**, 2742—2745).—The times (t) required for uniform drops (0·0063 c.c.) of C_6H_6 to evaporate from unimol. films of stearic acid in different states of compression (p) on H_2O have been measured. At $p >$ spreading pressure of C_6H_6, addition of C_6H_6 decreases p, which, on evaporation of C_6H_6, returns to its original val. When $p =$ spreading pressure a sudden and large increase in t is observed, C_6H_6 existing as a lens of visible thickness. At $p <$ spreading pressure t increases slowly until a sudden large increase in t occurs, a change in the focal length of the drop being observed. The dissolution of the film in C_6H_6 and its subsequent redeposition is discussed. W. R. A.

Mechanism of formation of films from emulsions of some high-polymeric substances. S. S. Vojutzki and E. M. Dzjadel (*Kolloid. Shurn.*, 1940, **6**, 717—728).—No films on glass can be obtained by evaporation of aq. emulsions of polyvinyl chloride (**I**). The nature and amount of plasticiser, emulsifying agent, etc. have no effect. Higher temp. (50°) is more advantageous than room temp. Films on Hg can be prepared, *e.g.*, from (**I**) 100 parts, Bu_2 phthalate 40, oleic acid 10, animal glue 10, $N(C_2H_4{\cdot}OH)_3$ 10, and H_2O 400. The tensile strength of the film increases with the temp. of drying from 0 for 50° to 87 kg. per sq. cm. for 150°; the total elongation simultaneously increases. The residues obtained at 25° consist of discrete spheres of (**I**), but they coalesce when the drying is carried out at 75° or higher. Films obtained by evaporation of a solution of (**I**) + plasticiser in $(CH_2Cl)_2$ are stronger than those given by emulsions. The indentation hardness of films from $(CH_2Cl)_2$ has a max. when the drying takes place at 40—50°. Films produced by evaporation of a rubber latex emulsion ("revertex") are stronger than those obtained by evaporation of a solution of "revertex" in C_6H_6; the latter films show no microscopical structure but the structure of the former also is visible only at a magnification >600. The difference in behaviour between (**I**) and rubber cannot yet be accounted for. J. J. B.

Validity of the phase rule for aërosols of water-soluble substances. N. N. Andreev (*Kolloid. Shurn.*, 1940, **6**, 831—834).—When NH_4Cl aërosols are prepared in moist air their turbidity increases with humidity, indicating a simultaneous increase in H_2O absorption by NH_4Cl. The total pressure p of moist air is lowered when it is mixed with a NH_4Cl aërosol, and the lowering agrees in the order of magnitude with that calc. for formation of a NH_4Cl solution in equilibrium with the humidity of the air; a better agreement could not be expected since p was measured only approx. The aërosols used contained 0·1—0·5 g. of NH_4Cl in 1 m.³, and the R.H. varied between 45 and 97%. It is concluded that the phase rule applies to aërosols. J. J. B.

Emulsion type. J. H. Hildebrand (*J. Physical Chem.*, 1941, **45**, 1303—1305).—Factors contributing to emulsion stability are discussed and an explanation is offered for the empirical rule that an emulsifying agent (E) tends to render the phase in which it is sol. the outside phase. If E is present in the film liquid, *i.e.*, the external phase, the resistance to sudden rupture is stronger than if E is in the emulsified drop, *i.e.*, the internal phase. In a thin film there is very little soap available to migrate to the new surface and weaken it, whereas there is an ample supply if it is sol. in the liquid outside of the film. In order for two drops to coalesce the separating film of the outer phase must become thinner at the point of threatened coalescence, and this would be resisted more strongly if E is dissolved in the film than if it is dissolved in the drops. C. R. H.

Absorption of light and heat radiation by small spherical particles.—See A., 1942, I, 9.

Absorption spectrum of suspensions of carbon black. A. J. Wells and W. R. Smith (*J. Physical Chem.*, 1941, **45**, 1055—1060).—The absorption spectra of suspensions of three standard commercial C blacks in rubber cement have been measured over the λ range 0·24—25 μ. There is a considerable reduction in transmission approaching the ultra-violet. The data are discussed in relation to Gamble and Barnett's method for calculating particle size, and it is shown that the latter is unsatisfactory for C blacks of the channel type. (Cf. B., 1937, 809.) C. R. H.

Viscosity of suspensions and solutions.—See A., 1942, I, 16.

Dispersion by supersonics. S. S. Urazovski and I. G. Polotzki (*Kolloid. Shurn.*, 1940, **6**, 779—785).—A piezo-quartz crystal operating at 3 kw. and 500 kc. per sec. was used. Aq. suspensions of camphor (up to 6 g. per l.) and I (5·7 g. in ordinary, and 1·5 g. in air-free, H_2O) were obtained. Suspensions of Ag or Cu were prepared by subjecting Ag or Cu cathodes in $AgNO_3$ or $Cu(NO_3)_2$ solutions to supersonics; they were unstable. J. J. B.

Synthesis of silver hydrosols by electrolysis. B. G. Zaprometov and F. M. Nurmuchamedov (*Kolloid. Shurn.*, 1940, **6**, 839—846).—Protected Ag sols are obtained by electrolysing at 95°, *e.g.*, 500 c.c. of 0·00005N-$NaNO_3$ or -$AgNO_3$ + 8 c.c. of 5% apricot gum (exudation from the tree trunks) between a Ag anode and a Pt cathode. They contain up to 0·06% of Ag and are black. To coagulate them within a few days 2 g. of solid $Al_2(SO_4)_3$ have to be added to 5 c.c. of sol. EtOH coagulates the sols when 5 c.c. are added to 1 c.c. of sol; the amount required in presence of $Al_2(SO_4)_3$ is less. The sols can be conc. 20 times by evaporation in a vac. at 20° without affecting their degree of dispersity. Gelatin and agar are less efficient protectors than apricot gum. J. J. B.

Tellurium and arsenic sulphide in the colloidal state. H. Bose (*Indian J. Physics*, 1941, **15**, 277—287).—A colloidal solution of Te does not give an X-ray pattern due to Te particles owing to the [Te] being too small. The following were examined with X-rays: (*a*) ppt. by HNO_3 from freshly

prepared sol; (*b*) ppt. by HNO_3 from heated sol; (*c*) dried-up gummy mass; (*d*) ppt. from aged sol; (*e*) ppt. from heated aged sol; (*f*) thin film which settles on the surface of a fresh sol during concn. (*a*) showed Te to be amorphous whilst the other samples, particularly (*f*), point to the existence of a new variety of Te. As_2S_3 sol behaves similarly in giving an amorphous pattern for freshly-prepared and a cryst. pattern for heated or aged sol. W. R. A.

Variations in electrochemical properties of silicic acid and hydrogen bentonite sols with temperature. J. Mukherjee, B. Chatterjee, and A. Sen (*J. Indian Chem. Soc.*, 1941, **18**, 283—285).—Potentiometric titration curves of SiO_2 sols and H bentonite sols at 1°, 35°, and 50° are shown. Unlike acids in true solution, the degree of dissociation in these sols does not materially change between 1° and 50°. F. L. U.

Silicic acid gels. XIII. Examples of re-gelation. C. B. Hurd and L. W. Thompson, jun. (*J. Physical Chem.*, 1941, **45**, 1263—1267).—H_2SiO_3 gels containing 3·5% of SiO_2 were beaten into fine particles with an equal vol. of H_2O and then centrifuged. Re-gelation of the pptd. mass occurred and the whole operation could be repeated several times after addition of an equal vol. of H_2O. The material produced by re-gelation was not truly elastic like the original gel but was more like a plastic or thick viscous fluid. Acid mixtures re-set more often than basic mixtures, mixtures with $p_H > 10{\cdot}5$ not re-setting at all. The p_H of the supernatant liquid after successive centrifuging increases, but the final p_H is not the same in all cases. C. R. H.

Thixotropic transformation of stabilised suspensions of graphite and ferric oxide. N. F. Jermolenko (*Kolloid. Shurn.*, 1940, **6**, 907—914).—Fe_2O_3 or graphite powder is shaken with 15—20 c.c. of an aq. solution of a stabiliser, left at rest for 5 min., and the amount x of powder still in suspension determined. The sediment can be dispersed by shaking again; this transformation is termed thixotropic. When the amount of powder increases, x passes through a max. which is reached at 0·6—1 g. of Fe_2O_3 in 0·0005N-HCl, at 0·3 g. of graphite in 0·0014M-picric acid, 0·009N-NaOH, or 0·01% eosin, at 0·5 g. of graphite in 0·03% tannin and in an oleic acid solution, and at 0·1 g. of graphite in 0·01% Congo-red. The position of the max. and the max. val. of x remain almost unchanged for weeks, showing that the electric double layer or the adsorbed stabiliser forms around the powder particles a cushion preventing contact. J. J. B.

Reversible aggregations of colloidal particles. I. Centrifugal experiments on thixotropic iron oxide sols. W. Heller (*J. Physical Chem.*, 1941, **45**, 1203—1227).—When a thixotropic sol is centrifuged it separates into an upper dil. sol phase and a thixotropic gel, the operation being reversible. Reversibility is not complete since a small proportion of the aggregates is irreversible and settles immediately on centrifuging as distinct from the reversible aggregates which settle slowly. Since the latter represent tiny elementary gels, the term "geloids" is proposed for them. The influences of ageing, electrolyte concn., org. substances, and weak mechanical vibrations have been investigated. The thixotropic sol-gel transformation can be divided into three steps: (1) building-up of gelation nuclei, probably twin particles; (2) formation of geloids around these nuclei; (3) association of geloids into a net-like gel structure, due either to the geloids, like tactoids, growing together after touching or else to mechanical entanglement. C. R. H.

Sedimentation of clays. II. A. S. Korshuev and Z. L. Borisova (*Kolloid. Shurn.*, 1940, **6**, 889—895).—The rate of sedimentation of clay is reduced by keeping the clay for a week in H_2O. It is lowered by 10^{-4}—10^{-5}N-NaCl and raised by higher [NaCl], lowered by Na_2SO_4 in >0·01N. solution, lowered by 10^{-4}—10^{-1}N-Na_2CO_3 and increased by N-Na_2CO_3, lowered by 0·01—1N-$CaCl_2$, slightly accelerated by $CaSO_4$, and reduced by $CaCO_3$. The sedimentation in presence of NaCl or $CaCl_2$ is the quicker the lower is the p_H (5·2—11·7). The sedimentation of various clays in ground water takes place throughout the whole extent of the suspension, but that of some clays in distilled H_2O occurs first at the bottom and the vol. of the sediment gradually grows. J. J. B.

Origin of the electric charge of clay particles. N. J. Denisov (*Kolloid. Shurn.*, 1940, **6**, 835—838).—Soils kept under a const. load contract when moistened with liquids; the contraction is 0·3—0·6% for light petroleum, 5—8% for $COMe_2$, 6—9% for EtOH, and 8—13% for H_2O. The contraction in N. solutions of $CaCl_2$ or NaCl is < in H_2O; this is attributed to a lowering of the electrokinetic potential which supposedly is due to a "surface dissolution" of clay particles. The angle of sliding of a soil may be, *e.g.*, 26° in H_2O, 29° in EtOH, and 35° in light petroleum. J. J. B.

Rate of formation of nuclei in supersaturated solutions of paraffin-chain salts.—See A., 1942, I, 16.

High mol. wt. aliphatic amines and salts. III. Behaviour of acetates of dodecylamine and octadecylamine in water. A. W. Ralston, C. W. Hoerr, and E. J. Hoffman (*J. Amer. Chem. Soc.*, 1941, **63**, 2576—2579; cf. A., 1941, I, 409).—Transition temp. and osmotic coeffs. for dodecylamine acetate–H_2O (**I**) and transition temp. and v.p. for octadecylamine acetate–H_2O (**II**) have been investigated. (**I**) and (**II**) showed crystalloidal properties in dil. aq. solution whilst in conc. solutions colloidal behaviour was observed. (**II**) exhibited a metastable region. W. R. A.

Thermodynamics of high polymeride solutions. P. J. Flory (*J. Chem. Physics*, 1941, **9**, 660—661).—A general statistical treatment applicable to all concns. of solutions of highly polymerised mols. has been developed on the basis of Meyer's model (A., 1941, I, 40). J. W. S.

Fractionation and size distribution in vinyl acetate polymerides. R. A. Blease and R. F. Tuckett (*Trans. Faraday Soc.*, 1941, **37**, 571—580).—Fractionation data obtained by pptg. $COMe_2$ solutions of three samples of polyvinyl acetate of different average chain lengths with aq. MeOH agree fairly with Schulz's theory (cf. A., 1937, I, 510). The size-distribution results are consistent with the view that the polymerisation process is terminated by mutual collision. F. L. U.

High-frequency energy losses in solutions containing macromolecules. W. P. Conner (*J. Chem. Physics*, 1941, **9**, 591—599).—An apparatus for accurate determination of the energy absorption of solutions containing polar mols. over the frequency range $0{\cdot}5$—15×10^6 cycles per sec. is described. Application of the Debye theory to the complex dielectric const. indicates that lignin is fairly homogeneous with mean mol. wt. ~3900 and shape factor 8, in accord with the results of diffusion, osmotic pressure, and viscosity investigations. It is also confirmed that polyesters of ω-hydroxydecoic acid show internal rotation of the polar groups in solution (cf. A., 1938, I, 232) and evidence is obtained that $CH_2{:}CMe{\cdot}CO_2Me$ polymerides have less, but still appreciable, internal group motions. J. W. S.

Dielectric constant of fractions of lyophilic colloids. Dielectric constant of agar fractions. M. S. Schulman (*Kolloid. Shurn.*, 1940, **6**, 747—751).—The dielectric const. ϵ of agar solutions is < that of H_2O. The ratio is, *e.g.*, 0·89 and 0·77 for 2·14% and 4·0% "insol." agar, and 0·89 for 2·0% "sol." agar. The "sol." agar was prepared by boiling ordinary agar for 60 hr. ϵ does not change when agar solutions are kept for days. Its temp. coeff. is identical with that of H_2O. $\lambda = 78$ m. was used. J. J. B.

Structural viscosity of pectin sols. S. A. Glikman (*Kolloid. Shurn.*, 1940, **6**, 925—937).—η of sols of pectin from orange skin and beetroot is measured in a capillary viscometer at various pressures. 2% solutions of orange pectin at 35° and 0·5% solutions at 15° show a normal η but the η of more conc. solutions or at lower temp. is the smaller the higher is the pressure. Beetroot pectin exhibits an abnormal η only at higher concns. than orange pectin. Addition of EtOH extends the concn. range of abnormal η; *e.g.*, in 20% EtOH a 0·8% solution of orange pectin shows more structural viscosity than a 2% solution in H_2O. $CaCl_2$ does not affect η of aq. solutions but it intensifies the abnormality of solutions in aq. EtOH. The additions of EtOH required to produce a noticeably abnormal η are similar to those causing gelation or coagulation within 24 hr. Reduction of η with increase of rate of flow takes place when the disruption of aggregates by shearing forces is more rapid than their re-formation. At higher temp. and dilution the aggregates are smaller and the rate of their re-formation is, therefore, higher; EtOH and $CaCl_2$ increase the size of aggregates and reduce the rate of their re-formation. J. J. B.

Colloidal behaviour of soap–starch systems.—See B., 1941, III, 328.

Heat of wetting of starch in solutions of non-electrolytes. A. I. Altov (*Kolloid. Shurn.*, 1940, **6**, 735—738).—The heat of wetting of starch by H_2O is 23·9 g.-cal. per g. At an equal mol. concn. sucrose reduces it > glucose > glycerol. $CO(NH_2)_2$ increases it. Assuming the heat of wetting to depend on the concn. of " free " H_2O, the amount of " bound " H_2O is calc. J. J. B.

Molecular properties of lignin solutions. D. L. Loughborough and A. J. Stamm (*J. Physical Chem.*, 1941, **45**, 1137—1138).—A calculating error in an earlier paper (cf. A., 1937, I, 183) is rectified. Since experimental data do not agree with newly calc. vals. it is argued that the Eisenschitz equation is inapplicable. Shape factor equations of Kuhn and of Onsager give vals. in better agreement with experiment. C. R. H.

Apparent volumes of colloids in solution. Z. P. Tschescheva and V. A. Tichonova (*Kolloid. Shurn.*, 1940, **6**, 915—923).—Vals. are given for the sp. gr. of cellulose acetate (I) solutions in $COMe_2$ at 20° and 25° and of starch and dextrin in H_2O at 25°. The apparent vol. of (I) decreases at 20° from 0·701 c.c. per g. in 3·5% to 0·656 in 1·25% solution, that of starch increases from 0·631 at 0·4% to 0·653 at 2·6%, and that of dextrin increases from 0·607 at 0·2% to 0·651 at 4·0%. Since the sp. vol. of dry (I) is 0·772, it appears to be solvated in $COMe_2$, and the degree of solvation increases with dilution. J. J. B.

Acid nature of cellulose. I. Equilibria between cellulose and salts. E. Heymann and G. Rabinov. **II. Strength of cellulosic acid.** G. Rabinov and E. Heymann (*J. Physical Chem.*, 1941, **45**, 1152—1166, 1167—1165).—I. Purified cation-free cotton-wool liberates the free acid from aq. solutions of salts, the amount liberated increasing with decreasing strength of the acid. The term " cellulosic acid " (I) is suggested for cation-free cellulose. Experimental evidence supports the view that the acid properties of (I) are due not only to OH groups but also to stray CO_2H groups. Oxidation increases and boiling alkali decreases the acid val. of (I) as a result, presumably, of a change in the no. of CO_2H.

II. An attempt to prove the existence of a H^+ atm. around the cellulose fibres by means of sugar inversion failed. A sol. acid somewhat stronger than AcOH can be obtained from cellulose by digestion at 70° for several days. Calculations of the dissociation const., k, of (I) give 10^{-4}—10^{-5} by formal application of the law of mass action, $0·6—1·5 \times 10^{-5}$ by application of the distribution equilibria of a base between two acids, and $< 10^{-4}$ by application of the Donnan equilibrium principle. The last method is, in principle, the most satisfactory, but it involves a factor (X = vol. of cellulose phase/vol. of solution phase) the val. of which can only be assumed. Calculations of kX give $5·0—6·5 \times 10^{-6}$, and the val. of $k = < 10^{-4}$ is based on the assumption that $X = \sim 0·03$. C. R. H.

Theory of gelation of lyophilic colloids. S. M. Liepatov and R. I. Feldman (*Kolloid. Shurn.*, 1940, **6**, 805—813).—When a gelatin (I) or agar sol is cooled from 40° to 20° side by side with H_2O, the difference of temp. between sol and H_2O first increases to a max., ΔT, and then decreases again. ΔT is assumed to be $\propto$ the latent heat of gelation. For 5% sols it is for " insol." fractions > for ordinary (I) or agar; for agar it is about twice as high as for (I). (I) sols containing 5% of " insol." fractions and 1% of " sol." fractions have a lower (by 10—60%) ΔT than 5% sols of " insol." fractions alone; this shows that the heat of gelation is not due to hydration. Heat is evolved since micelles of " insol." (I) come together, thus reducing their surface area; when the free surface area is lowered by adsorption of " sol." (I), its further reduction during gelation liberates less heat. J. J. B.

Theory of gelation of lyophilic colloids. I. II. Factors affecting heat of gelation. R. I. Feldman (*Kolloid. Shurn.*, 1940, **6**, 753—760, 875—882).—I. The heat H evolved during gelation of a gelatin (I) sol decreases when the sample is repeatedly warmed to the sol, and cooled to the gel, state; *e.g.*, H evolved during the sixth cooling of a 5% (I) was ⅓ of that at the first cooling. H is the smaller the higher is the temp. at which the sol was prepared (40—100°). Each warming of (I) increases the % of low-mol. fractions in it and in this way depresses H. Repeated melting and gelation of agar also increases its H, but to a smaller degree than with (I).

II. H for (I) sols prepared at 40° increases with concn. from 10% to 30%; no abs. vals. are given. H is reduced by 0·1N-salts in the order $FeCl_3$, $AlCl_3$ > $BaCl_2$ > NaCl. The viscosity of 5% (I) is raised by 0·1N-$AlCl_3$ or $FeCl_3$ > $BaCl_2$ > NaCl. The cations are adsorbed by gelatin micelles and reduce their surface area (hence the reduced vals. of H) and they increase the charge on the micelles, thus intensifying the electro-viscous effect. J. J. B.

Solvation of gelatin. E. Heymann (*J. Physical Chem.*, 1941, **45**, 1143—1151).—The hydration of gelatin (I) has been determined from the min. amount of H_2O present in (I) which causes zero vol. contraction on swelling in H_2O. The data indicate that hydration = 0·6—0·7 g. of bound H_2O per g. of dry (I), a val. which is reduced to 0·25 if the measurements are made in 40% $(NH_4)_2SO_4$, thus illustrating the dehydrating effect of this salt. The results are compared with those obtained by other methods involving different definitions of bound H_2O. There is a vol. decrease during sol–gel transformation of (I) in aq. EtOH as there is in aq. solutions. The complete isotherm of the apparent adsorption of dry (I) in aq. EtOH has been determined in order to show which of the constituents is preferentially adsorbed. The results show that (I) particles contain EtOH besides H_2O in the solvation layer, and that the ratio H_2O : EtOH increases with decrease in temp. This bears on the observation that gel formation in (I) solutions on cooling is accompanied by, although probably not the result of, increasing hydration of the particles. C. R. H.

Heat of coagulation of solutions of gelatin fractions. P. M. Lapin and S. M. Liepatov (*Kolloid. Shurn.*, 1940, **6**, 897—905).—Equal amounts of EtOH are added to a gelatin (I) solution and to H_2O; the difference in the heats evolved is the heat of coagulation, Q. It is measured only in relative units. Q referred to 1 g. of (I) increases with dilution and decreases on keeping a 3% solution for days. It is independent of temp. between 24° and 60°. " Sol." fractions have a larger Q than " insol." ones and increase Q of the latter when added in considerable amounts. Q of a 2% (I) sol is reduced by a pre-warming of (I) for 12 hr. at 105°. It is assumed that Q is the heat of surface dehydration of (I) micelles, and from variations of Q conclusions are drawn about the conditions on the micelle surface. A few observations are reported on Q of agar. J. J. B.

Peptising action of heat-disaggregated gelatin. I. I. Sokolov (*Kolloid. Shurn.*, 1940, **6**, 815—822).—The periodicity const. λv of ordinary gelatin (I) is lowered by addition of gelatin which has been boiled for 60 hr. λ is the distance between two consecutive periodic pptns. of $Ag_2Cr_2O_7$ in (I), and v the rate of diffusion. For a 10% (I) gel, $K_2Cr_2O_7$ in 0·1-saturated solution, and $AgNO_3$ in 0·16-saturated solution, λv is $6·1 \times 10^{-6}$ cm.^{2} per sec.; when (I) contains 3% of disaggregated (I) λv is $3·5 \times 10^{-6}$. v increases when λv decreases. This means that disaggregated gelatin loosens the structure of (I) gels; its particles are adsorbed by the chains of normal (I) and prevent their cross-linking. J. J. B.

Coagulation of gelatin under pressure. O. I. Leipunski (*J. Phys. Chem. Russ.*, 1940, **14**, 1517—1519).—The transition of sol to gel is accelerated by an increase of pressure. Viscosity measurements indicate that at a pressure of 2000 atm. the initial coagulation is increased 2—2½ times. E. Ad.

Influence of gelatin on precipitation of silver chromate. IV. Combination of gelatin with silver ions. T. R. Bolam and K. F. MacBean (*Trans. Faraday Soc.*, 1941, **37**, 549—562; cf. A., 1933, 1011).—The combination of gelatin (I) with Ag ions has been investigated by determining the concn. of Ag^+ required to produce a ppt. of Ag_2CrO_4 in presence of varying concns. of (I). The decrease in the activity of Ag^+ in solutions of $AgNO_3$ containing (I) is almost entirely due to combination with the protein. At const. free [Ag^+] the combination is independent of (I) concn., and increases with p_H slowly between 7·0 and 9·0 and rapidly between 9·0 and 10·5. Deamination of (I) slightly increases the combination at p_H 7·0 but has no effect at 10·5. It is inferred that Ag^+ does not combine by forming complexes with the free NH_2 of (I). At const. [$AgNO_3$] there is a linear relation between log [Ag^+] and (I) concn. The inhibitive action of (I) on the pptn. of Ag_2CrO_4 reaches a max. at 0·2% (I), which is not affected by deamination, thermo-hydrolysis, or variation of p_H between 7·0 and 10·5. F. L. U.

Precipitation of silver chromate. III. Gelatin medium.—See A., 1942, I, 68.

Influence of Congo[-red] on the coagulation of animal proteins by copper salts. II. B. S. Putschkovski (*Kolloid. Shurn.*, 1940, **6**, 823—829).—Coagulation of protein–Congo-red–$CuSO_4$ mixtures can be used for differentiating between albumin and globulin. The ovoglobulin used contained 40% of $(NH_4)_2SO_4$, but $(NH_4)_2SO_4$ did not affect the coagulation of Congo-red by $CuSO_4$. 0·1N-$CuSO_4$ does not ppt. 0·037% globulin sols, but it coagulates mixtures of 0·037% globulin and 0·0015% Congo-red in lower concns. than analogous albumin mixtures. In slightly alkaline and slightly acidified H_2O globulin is pptd. by $CuSO_4$ less easily than albumin, but albumin–Congo-red mixtures are pptd. less readily than globulin–Congo-red mixtures. J. J. B.

Influence of anions on coagulation of arsenic trisulphide hydrosol. I. V. P. Mischin and V. P. Faidisch (*Kolloid. Shurn.*, 1940, **6**, 711—715).—The amount a of electrolyte required for coagulating within 2 hr. an As_2S_3 hydrosol containing 13 millimols. per l. increases in the order KCl < KOAc < $EtCO_2K$ < $Pr^{\alpha}CO_2K$ < $BuCO_2K$. The a of KCl is raised when the sol contains small amounts of HCO_2K < KOAc < $EtCO_2K$ < $Pr^{\alpha}CO_2K$; this increase has a max. when the concn. of the org. K salt is 20 millimols. per l. Fatty acid anions stabilise As_2S_3, and the stabilisation increases with their mol. wt. J. J. B.

Protective properties of gums of fruit trees. B. G. Zapropmetov and F. M. Nurmuchamedov (*Kolloid. Shurn.*, 1940, **6**, 705—710).—Gum gathered from trunk and branches of apricot and peach trees in spring contains 11—13% of H_2O, 45—48% of pentosan, and 2·8—3·6% of ash; 79—84% is sol. in H_2O. Its aq. solution protects Au and As_2S_3 sols as well as does gum arabic. In the conductometric titration of a protected As_2S_3 sol with NaCl no decrease of conductivity at the threshold of coagulation takes place. The protective effect increases for several hr. after As_2S_3 and gum have been mixed. A protected Ag sol is obtained by heating, *e.g.*, 0·8 c.c. of N-$AgNO_3$, 69·2 c.c. of H_2O, and 30 c.c. of 7% gum solution. Such sols can be pptd. by EtOH or $COMe_2$, and the ppt. redissolved in H_2O. J. J. B.

Technique of determination of the sign of charge and of the magnitude of electrokinetic potential by electro-osmosis. S. N. Aleschin (*Kolloid. Shurn.*, 1940, **6**, 701—704).—A simple electro-osmotic apparatus is described. The diaphragm is produced in the bend of a U-tube by centrifuging the tube filled with a soil suspension. Results for three soils are given. J. J. B.

Effect of electrolytes on the cataphoretic mobility of colloidal carbon. L. Ts'ai and S. Chiang (*J. Physical Chem.*, 1941, **45**, 1093—1096).—Cations reduce and anions increase the migration velocities of colloidal C, the effect being greater for ions of higher valency. The reduction caused by $AlCl_3$, and $FeCl_3$ is very pronounced, the sign of the C particles being reversed at very low cation concn. as a result of cation adsorption. C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Super-molecule formation. K. L. Wolf, H. Dunken, and K. Merkel (*Z. physikal. Chem.*, 1940, **B**, **46**, 287—312).—Relationships arising from the application of the law of mass action to the problem of association (" super-mol. formation ") are deduced and considered. Equilibrium consts. for a no. of substances in various solvents in which association occurs are given. Three types of association may be distinguished. In the first case there is equilibrium between single mols. and only one type of associated mol., *e.g.*, the higher fatty acids, which, in C_6H_6 or *cyclo*hexane (**I**), associate almost exclusively to double mols. In the second type there is equilibrium between single mols. and a no. of associated mols. of different complexity, but with a decided preference for one particular associated mol., *e.g.*, the lower fatty acids in C_6H_6 or (**I**). Thirdly, there may be equilibrium between single mols. and associated mols. of various complexities, so that the equilibrium consts. are independent of the complexity, *i.e.*, the equilibrium const. between one associated mol. and the next is const. throughout the series. This occurs with the *n*-aliphatic alcohols in (**I**), C_6H_6, and dioxan, PhOH in CCl_4, H_2O in dioxan, etc. A no. of physical properties of liquid mixtures, such as the variation of heat of mixing with concn., and the change of vol. on mixing, can be obtained quantitatively by the application of the law of mass action. A. J. M.

Spectroscopic determination of association equilibria. H. Kempter and R. Mecke (*Z. physikal. Chem.*, 1940, **B**, **46**, 229—241; cf. A., 1939, I, 564).—The intensity of the sharp " OH band," 968 mμ., of PhOH in CCl_4 solution has been measured in absorption for concns. from 0·0375 to 6·0M. It is supposed that the extinction coeff. at concn. c, ϵ_c, for this band is $\propto a$, the fraction of the total PhOH mols. which is present as single mols. The variation of ϵ_c with c is well expressed as due to the change in a in accordance with the law of mass action as applied to the equilibrium $PhOH + (PhOH)_n \rightleftharpoons (PhOH)_{n+1}$. The distribution of the mols. with respect to n is shown for the above range of concn. At the highest concn. ¼ of the mols. have $n > 10$, and no upper limit to n is apparent. The extinction coeff. ϵ_c(CH) of the aromatic CH band, 872 mμ., is shown to vary according to the equation $\epsilon_c(CH) = 0{\cdot}0430 \times 10^{-4}a + 0{\cdot}0356 \times 10^{-4}(1 - a)$. O. D. S.

Ionisation constant of formic acid in dioxan–water mixtures. H. S. Harned and R. S. Done (*J. Amer. Chem. Soc.*, 1941, **63**, 2579—2582).—By means of cells of the type H_2|$HCO_2H(m)$, $HCO_2Na(m)$, dioxan (X), H_2O (Y)|AgCl–Ag the ionisation const. (K) of HCO_2H has been determined at 5° intervals from 0° to 50°, $X = 20$—82%. K varies with temp. according to $\log K = -A/T + B - CT$, where A, B, and C are empirical consts. Vals. of $\Delta G°$, $\Delta H°$, $\Delta C_p°$, and $\Delta S°$ of ionisation have been calc. W. R. A.

Dissociation constant of bromocresol-green in water. M. Kilpatrick (*J. Amer. Chem. Soc.*, 1941, **63**, 2667—2668).—The thermodynamic dissociation const. of bromocresol-green (**I**) (from yellow to blue) at 25° is $1{\cdot}11 \times 10^{-5}$ from colorimetric determination of the reactions between acetate or benzoate and (**I**). W. R. A.

Complex ions. II. Stability and activity coefficients of the silver-ammonia ion. P. F. Derr, R. M. Stockdale, and W. C. Vosburgh (*J. Amer. Chem. Soc.*, 1941, **63**, 2670—2674).—Vals. for the solubility of $AgIO_3$ in aq. KNO_3 have been obtained in good agreement with recorded data (A., 1938, I, 134; 1941, I, 211). The solubility of $AgIO_3$ in aq. NH_3 has been determined and from the data the instability const., $K = [Ag^{\cdot}][NH_3]^2/[Ag(NH_3)_2^{\cdot}]$, has been derived. The solubility of AgCl in aq. NH_3 in presence of KNO_3 or KCl depends on [Cl′], [NH_3], and ionic strength. W. R. A.

Isopiestic measurements on solutions of potassium chromate and potassium dichromate. R. H. Stokes, J. M. Wilson, and R. A. Robinson (*Trans. Faraday Soc.*, 1941, **37**, 566—569).—Data for the osmotic (ϕ) and activity (γ) coeffs. of K_2CrO_4 (0·1—3·4M.) and $K_2Cr_2O_7$ (0·1—0·5M.) at 25° are tabulated, the reference substance being KCl. The vals. for K_2CrO_4 are very close to the corresponding vals. for $Na_2S_2O_3$ (cf. A., 1941, I, 265). ϕ for $K_2Cr_2O_7$ is anomalous and indicates an increase in the no. of ions with dilution, probably according to $Cr_2O_7'' + H_2O \rightleftharpoons 2HCrO_4'$, for which an approx. equilibrium const. (18·4—23·0) is calc. F. L. U.

Osmotic and activity coefficients of silver nitrate at 25°. R. A. Robinson and D. A. Tait (*Trans. Faraday Soc.*, 1941, **37**, 569—570).—Isopiestic v.p. measurements against KCl have been made up to [$AgNO_3$] = 13·5M., and osmotic and activity coeffs. are tabulated. Up to 3M. γ vals. for $AgNO_3$ and $RbNO_3$ are almost the same. Very low vals. of γ are found in conc. solutions, and no min. occurs in the γ–$\sqrt{m}$ curve. F. L. U.

Activity coefficient of silver acetate in some dioxan–water mixtures in presence of added electrolytes. J. E. Ricci and A. R. Leo (*J. Physical Chem.*, 1941, **45**, 1096—1103).—The solubilities at 25° of AgOAc in 20, 30, and 50% dioxan in presence of 0—1·0M-$NaNO_3$ and -$NaClO_3$ are tabulated. The Debye–Hückel equations hold fairly well for the whole range of dielectric const. covered. The activity coeff. of AgOAc at saturation in pure solvent is approx. const., decreasing from 0·800 in H_2O to 0·729 in 50% dioxan. The observed solubility at zero ionic strength has been compared with the val. calc. from the Born equation. Agreement is fair up to 30% dioxan but is very poor for 50% dioxan on account of physical effects which are neglected in extending the Born equation to low dielectric consts. C. R. H.

Ternary system ammonium nitrate–ammonium sulphate–water at 25°. R. K. Bahl and S. Singh (*J. Indian Chem. Soc.*, 1941, **18**, 307—308).—Two double salts,

$(NH_4)_2SO_4,2NH_4NO_3$ and $(NH_4)_2SO_4,3NH_4NO_3$, but no salt hydrate, are formed. D. F. R.

Singular isotherms of the systems Na_2O–SO_3–H_2O and K_2O–SO_3–H_2O. N. S. Kurnakov, V. A. Mazel, V. M. Filippeo, and N. K. Voskresenskaja (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 321—326).—The phase diagrams of the systems at 25° are given. The confirm earlier work. R. T.

Solubility isotherms of the system K_2CO_3–$KMnO_4$–H_2O. V. M. Filippeo and N. K. Voskresenskaja (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 327—329).—The phase diagram of the system at 25° is given. The solubility of K_2CO_3 is unaffected by $KMnO_4$; that of $KMnO_4$ falls with increasing $[K_2CO_3]$. R. T.

Solubility diagram for the system vinyl acetate–acetic acid–water. J. C. Smith (*J. Physical Chem.*, 1941, **45**, 1301—1303).—A triangular solubility diagram for the system at 28° has been constructed. C. R. H.

Double decomposition in absence of a solvent. LII. Mutual system: chlorides and bromides of lead and thallium. L. I. Favorski. **LIII. Irreversible mutual system: nitrates and chlorides of lithium and sodium.** V. P. Blidin. **LIV. Quaternary mutual system: fluorides, bromides, and chlorides of sodium and potassium.** V. D. Poliakov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 281—289, 291—297, 299—320).—LII. Mönkemeyer's findings (A., 1906, ii, 604) for the systems $PbCl_2$–$PbBr_2$ and TlCl–TlBr are confirmed, with minor modifications. In the system $PbCl_2$–TlCl a 1 : 1 *compound*, m.p. 397° (decomp.), is formed, in addition to the 2 : 1 and 1 : 3 compounds reported by Korreng (A., 1914, ii, 205). 2 : 1, m.p. 395°, 1 : 1, m.p. 368° (decomp.), and 1 : 3, m.p. 392°, *compounds* are formed in the system $PbBr_2$–TlBr. The phase diagram of the system $PbCl_2 + 2TlBr \rightleftharpoons PbBr_2 + 2TlCl$ is constructed from the above data.

LIII. Fusion diagrams for the systems $LiNO_3$–$NaNO_3$, $LiNO_3$–LiCl, $LiNO_3$–NaCl, and $NaNO_3$–LiCl are given, and the phase diagram of the system $NaNO_3 + LiCl \rightleftharpoons NaCl + LiNO_3$ is hence constructed.

LIV. The phase diagram of the system NaF–NaCl–NaBr–KF–KCl–KBr is constructed, on the basis of the constituent binary, ternary, and quaternary systems. R. T.

Mutual system $Cu_2Cl_2 + Ag_2S \rightleftharpoons 2AgCl + Cu_2S$. G. G. Urazov and L. A. Tschelidze (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 263—280).—Equilibrium is shifted completely in the direction of the reaction $2CuCl + Ag_2S \rightarrow 2AgCl + Cu_2S$ when the melt is cooled to room temp. Fusion diagrams are recorded for the ternary systems CuCl–AgCl–Cu_2S and AgCl–Ag_2S–Cu_2S; the latter system is complicated by formation of solid solutions of Ag_2S in Cu_2S. R. T.

Representation of multi-component systems as projections of regular figures. Quinary systems. V. P. Radischtschev (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 85—108).—Geometrical principles of representation of properties of quinary systems are developed. R. T.

Heats of combustion and of formation of the nine isomeric heptanes in the liquid state. G. F. Davies and E. C. Gilbert (*J. Amer. Chem. Soc.*, 1941, **63**, 2730—2732).—Using the adiabatic calorimeter previously described (A., 1939, I, 612) the isothermal heats of combustion of nine isomeric heptanes have been measured at 25° and from these data vals. for the energies of isomerisation in the liquid state and for the heats of formation at 25° have been calc. W. R. A.

Partial pressure of hydrogen chloride from its solutions in some aprotic solvents and the calculation of the heat and entropy of dissolution. S. J. O'Brien (*J. Amer. Chem. Soc.*, 1941, **63**, 2709—2712).—The partial pressures of HCl from its solution in PhCl and C_6H_6 at 30° and 40°, and in $PhNO_2$ at 20°, 25°, 30°, and 40°, have been measured. Vals. of the heat and entropy of dissolution of HCl in these and six other solvents have been deduced. ΔS of HCl on dissolution corresponds linearly with the shift produced by the solvent on the 3·46 μ. vibrational band of HCl. W. R. A.

Heats of dissolution and reaction in anhydrous liquid ammonia. VI. F. C. Schmidt, J. Sottysiak, E. Tajkowski, and W. A. Denison (*J. Amer. Chem. Soc.*, 1941, **63**, 2669—2670).—Mol. heats of dissolution at −33·4° for NH_4I, NaI, $NaNO_3$, NaCl, MeOH, Pr^{n}OH, Bu^{n}OH, CH_2Ph·OH, and furfuryl alcohol are reported. NH_4I and NaI have a negative heat of dilution. W. R. A.

Heats of dissolution of monatomic ions in methyl alcohol. D. D. Eley and D. C. Pepper (*Trans. Faraday Soc.*, 1941, **37**, 581—587).—Heats of dissolution of Li^+, Na^+, K^+, Cl^-, Br^-, and I^- in MeOH are evaluated by the method previously used for H_2O (A., 1938, I, 519), a similar model of the ionic solution being assumed. Entropies of dissolution are much more negative in MeOH than in H_2O, and cannot be accounted for by the same simple model. It is suggested that the first shell of oriented MeOH dipoles can impose a similar orientation over a shell several mols. thick. F. L. U.

Free energies of reactions of calcium carbide. F. B. West and R. E. Montonna (*J. Physical Chem.*, 1941, **45**, 1179—1194).—The free energies, heats of reaction, and heat capacity changes at 25° of 68 reactions involving CaC_2 and 40 reagents have been evaluated. In only five reactions, viz., decomp. of CaC_2, and reactions of CaC_2 with H_2, NH_3 (forming C_2H_2 in each case), C_2H_2, and NH_2Ac, are the free energies positive. In the reactions with the halogens there is a sharp decrease in free energy with increasing mol. wt., but the difference is negligible between the members of the halogen acids, alkyl halides, and acyl halides. C. R. H.

VII.—ELECTROCHEMISTRY.

Conductance of hydrochloric acid in aqueous solutions from 5 to 65°. B. B. Owen and F. H. Sweeton (*J. Amer. Chem. Soc.*, 1941, **63**, 2811—2817).—The conductance of HCl in H_2O has been determined at 10° intervals from 5° to 65° and at 0·001—15M., using a special cell technique. Λ^0 is evaluated at each temp. Vals. of Λ and the corresponding temp. coeffs. are tabulated at even vals. of $\sqrt{c}$ and at several temp. Using existent data for the transference nos., ionic mobilities and the corresponding temp. coeffs. have been calc. The temp. coeff. of the Cl^- mobility appears to increase with temp. in contrast to H^+ and other ions, and the contribution of experimental error to the apparent increase is discussed. W. R. A.

Influence of temperature on the electrical conductivity and viscosity of aqueous mercuric chloride. S. S. Joshi and D. N. Solanki (*J. Indian Chem. Soc.*, 1940, **17**, 627—647).—The conductivity and viscosity of aq. $HgCl_2$ have been determined from 0·125 to 0·00939M. and from 15° to 40°. The conductivity is very low but the temp. coeff. is high (3·8—6·2%) and the results suggest that $HgCl_2$, apart from binary dissociation, gives other and more complex ions. The temp. coeff. of the viscosity almost equals that of pure H_2O. D. F. R.

Temperature coefficient of the electric conductivity of solutions of *m*- and *p*-aminobenzoic acids. I. N. Beljaev (*Kolloid. Shurn.*, 1940, **6**, 729—733).—For 0·005N-*m*-NH_2·C_6H_4·CO_2H $\kappa \times 10^6$ is 74 and 225 at 10·3° and 96·0°, for 0·010N. it is 74 and 326 at 10·0 and 95·8°, and for 0·015N. it is 92 and 409 at 9·0° and 90·4°. For the *p*-acid it is: 0·005N. 61 and 163 at 13·1° and 97·5°; 0·010N. 69 and 207 at 9·0° and 91·5°; 0·015N. 90 and 246 at 12·0° and 96·0°. κ rises with temp. linearly up to ~60°. The smaller temp. coeff. of the *p*-acid is probably due to its containing more of the dipolar form than does the *m*-acid. J. J. B.

Transference numbers of sulphuric acid in anhydrous methanol at 25°. E. W. Kanning and J. E. Waltz (*J. Amer. Chem. Soc.*, 1941, **63**, 2676—2678).—From e.m.f. measurements at 25° the activity coeffs. and cation transference nos. (t) of H_2SO_4 have been determined in 0·01375—0·54434M. solutions in anhyd. MeOH. Vals. of t are ~0·1 < those for aq. solutions. W. R. A.

Platinised porous graphite as a hydrogen electrode. F. Hovorka and R. D. Evans (*Trans. Electrochem. Soc.*, 1941, **80**, *Preprint* 22, 243—251).—Platinised graphite electrodes, prepared by a process combining thermal decomp. and electrodeposition, give reproducible vals. for the potential and rapidly attain equilibrium. Over the p_H range 1·48—12·07 at 25° the potential of the electrode, referred to the normal H scale, is $0·0009 - 0·05914p_H$ v. The electrode is especially recommended for determining the p_H val. of solutions containing high concns. of light-metal salts. J. W. C.

Influence of the p_H of a solution on the corrosion and electrode potential of copper. G. V. Akimov and I. L. Rosenfeld (*J. Phys. Chem. Russ.*, 1940, **14**, 1486—1494).—In aq. solutions of varied p_H (HCl and NaOH, with and without 0·01N-NaCl) the electrode potential of Cu is displaced towards

negative vals. with decrease of p_H between 3 and 0. This can be explained by (1) high concn. of Cl′, (2) destruction of the protective film of Cu_2O by Cl′, and (2) the possible formation of simple and complex compounds, the latter causing also considerable corrosion of the Cu. In the range p_H 3—10 Cu has a more positive electrode potential and undergoes insignificant corrosion, owing to the stability of the protective film and the formation of electrodes of the second kind. In the range p_H 10—14 the potential is again displaced towards negative vals., and corrosion is increased, as the result of dissolution of the protective film with formation of the cuprites Na_2CuO_2 and $NaHCuO_2$. The max. of the potential–p_H curve does not coincide with that of the corrosion–p_H curve. E. AD.

Silicon carbide electrode. D. N. Hume and I. M. Kolthoff (*J. Amer. Chem. Soc.*, 1941, **63**, 2805—2806).—SiC electrodes have been used against calomel and quinhydrone electrodes for the potentiometric titration of (i) KI with $KMnO_4$ and with $Ce(SO_4)_2$, (ii) HCl with NaOH, (iii) $Fe^{..}$ with $KMnO_4$, and (iv) $TiCl_3$ with $FeCl_3$. SiC electrodes behave as an ordinary oxidation–reduction indicator like Pt. The use of SiC electrodes is not recommended owing to the difficulty of prep., high resistance, sluggishness in unpoised systems, and untrustworthiness in bimetallic pairs. Earlier results at variance with the present data are attributed to direct contact between solution and metallic conductor and not to any property of SiC itself. W. R. A.

Lead amalgam–lead fluoride electrode and thermodynamic properties of aqueous sodium fluoride solutions. R. W. Ivett and T. de Vries (*J. Amer. Chem. Soc.*, 1941, **63**, 2821—2825).—A saturated aq. solution of NaF is 0·983M. at 25°. The e.m.f. of cells of the type Na–Hg|NaF(*m*)|PbF_2, Pb–Hg have been measured at 15°, 25°, and 35° (m = 0·1 to 0·9M.). The mean activity coeffs. of NaF from 0·01M. to saturation, and ΔG, ΔH, and ΔS for the reaction $2Na + PbF_2 = NaF\ (aq.) + Pb$ and for the dilution of NaF, have been calc. The activity product const. of PbF_2 has also been calc. W. R. A.

Voltaminetry with stationary micro-electrodes of platinum wire. H. A. Laitinen and I. M. Kolthoff (*J. Physical Chem.*, 1941, **45**, 1061—1079).—The determination and interpretation of current–voltage curves (voltammetry) obtained for deposition, reduction, and oxidation reactions is described. In the deposition of metal ions a region of const. diffusion current was obtained, and in the case of TlCl there is a linear relation between [TlCl] and the diffusion current of Tl. A similar proportionality between ion concn. and diffusion current was observed in the reduction and oxidation reactions $Fe^{'''} \rightleftharpoons Fe^{..}$ and $Fe(CN)_6^{'''} \rightleftharpoons Fe(CN)_6^{''''}$. The diffusion current at the same equiv. concn. of diffusing substance $\propto$ diffusion coeff. for $Tl^{\cdot}$, $Ag^{\cdot}$, $Cu^{..}$, $Fe(CN)_6^{'''}$, $Fe(CN)_6^{''''}$, and O_2, thus indicating that the effective diffusion layer thickness (l) is approx. const. for various electrode processes. l depends on the total salt concn. and decreases slightly with rise in temp. (Cf. A., 1942, I, 75.) C. R. H.

Current–voltage curves of mercurous and mercuric salts at the dropping mercury electrode. I. M. Kolthoff and C. S. Miller (*J. Amer. Chem. Soc.*, 1941, **63**, 2732—2734).—$Hg^{..}$ in $Hg(NO_3)_2$ and $HgCl_2$ with 0·1N-HNO_3 and 0·1N-KNO_3, respectively, as supporting electrolyte, and $Hg_2^{..}$ in $Hg_2(NO_3)_2$ with 0·1N-HNO_3 as supporting electrolyte have been determined polarographically at 25°, at the dropping Hg electrode using tropæolin OO, Me-red, and gelatin as max. suppressors. The equilibrium $Hg^{..} + Hg \rightleftharpoons Hg_2^{..}$ is attained practically instantaneously. $HgCl_2$ yields Hg_2Cl_2 quantitatively at the surface of the electrode. In 0·1N-HNO_3 at 25° the diffusion coeffs. of $Hg_2^{..}$ and $Hg^{..}$ are 0·92 and 0·82 $\times$ 10^{-5} cm.^{2} sec.$^{-1}$, respectively. W. R. A.

Reduction of sulphurous acid (sulphur dioxide) at the dropping mercury electrode. I. M. Kolthoff and C. S. Miller (*J. Amer. Chem. Soc.*, 1941, **63**, 2818—2821).—SO_2, produced in solution from Na_2SO_3 and 0·1—1N-strong acids, has been determined polarographically at 25° at the dropping Hg electrode. The diffusion current (i) $\propto$ the total [SO_2]. The reduction is accounted for quantitatively by the reaction: $SO_2 + 2H^{\cdot} + 2e \rightarrow H_2S_2O_2$ (cf. A., 1930, 706). With total [Na_2SO_3] const., i decreases markedly at $p_H < 2$. At $p_H > 4$ only one wave is observed but at p_H 6 two small waves appear, the first corresponding with reduction to hyposulphite (I) and the second to reduction of (I) to thiosulphate. At $p_H < 7$ no wave is observed. The behaviour over the p_H range studied is attributed to H_2SO_3 existing in two tautomeric forms, (i) strongly acidic and oxidisable and (ii) weakly acidic and reducible. The speed of the transformation of (i) into (ii) is relatively small. The diffusion coeff. of SO_2 in aq. media is $2{\cdot}04 \times 10^{-5}$ cm.^{2} sec.$^{-1}$ at 25°. W. R. A.

Indium. III. Electrometric study of precipitation of hydrous indium hydroxide. T. Moeller (*J. Amer. Chem. Soc.*, 1941, **63**, 2625—2628; cf. A., 1941, I, 343).—The titration of 0·0493M-$In_2(SO_4)_3$, 0·1M-$In(NO_3)_3$, and 0·1M-$InCl_3$ with 0·1N-NaOH, -KOH, and -aq. NH_3 has been investigated at 10°, 25°, and 40°. Pptn. began at p_H 3·41—3·43 and the colloidal sol thus produced flocculated before the ratio of 3 OH′ : $In^{'''}$ was attained. At 25° a mol. ratio of 0·84 OH′ : 1·0 $In^{'''}$ must be reached before $In(OH)_3$ is pptd. from $In_2(SO_4)_3$ or $In(NO_3)_3$. For $InCl_3$ the ratio was 0·02, assuming that the ultimate ppt. is $In(OH)_3$. The solubility product at 25° is $\sim 10^{-23}$, in agreement with existent data, whilst the corresponding H_2O-solubility is 2·3, 2·1, and 4·1 $\times$ 10^{-9} g.-mol. per l. calc. from $In_2(SO_4)_3$, $In(NO_3)_3$, and $InCl_3$, respectively, which is attributed to the tendency of $InCl_3$ to exist in H_2O as anionic complexes. The solubility of hydrous $In(OH)_3$ trebles from 10° to 40°. At 25° variation in the initial [$In^{'''}$] between 0·005M. and 0·02466M. produced no effect on the p_H at which pptn. began. Part of $In(OH)_3$ is peptised to a negative sol when treated with excess of NaOH or KOH. W. R. A.

VIII.—REACTIONS.

Monocyclic reactions with three centres. G. E. Hay and H. J. McDonald (*J. Physical Chem.*, 1941, **45**, 1177—1178).—One of the reactions considered by Semenoff (cf. A., 1939, I, 568; *Amer. Document. Inst.*, *Document* 1596) is treated mathematically in an extended form. C. R. H.

Semi-empirical calculations of activation energies. J. O. Hirschfelder (*J. Chem. Physics*, 1941, **9**, 645—653).—Activation energies (E) calc. by Eyring's semi-empirical method are in most cases in satisfactory agreement with experiment. E as determined experimentally appears not to be greatly dependent on at. size or on diat. force consts., but to be a function of the binding energies only. It is shown semi-empirically that for exothermic reactions of the type $a + bc \rightarrow ab + c$, $E = 0{\cdot}055D'_{bc}$, where D'_{bc} is the energy of the bond bc, whilst for exothermic reactions of the type $ab + cd \rightarrow ac + bd$ it is $0{\cdot}28(D'_{ab} + D'_{cd})$. J. W. S.

Explosive reactions of gases. II. Spark ignition of oxyhydrogen gas at low pressures. A. Hayakawa and R. Goto (*Rev. Phys. Chem. Japan*, 1941, **15**, 117—125).—When the sparking potential is plotted against the sparking pressure a wedge-shape curve ("peninsula") enclosing a region of spark ignition and surrounded on one side by a region of non-spark and on the other by a region of spark without ignition is obtained. Such spark-ignition peninsulas for H_2–O_2 (1 : 1) mixtures have been demonstrated. In air, corresponding spark peninsulas (*i.e.*, without ignition) are obtained. The upper pressure limit in the case of spark ignition agrees with that of the spark itself. C. R. H.

Reaction between hydrogen and oxygen: kinetics of the third explosion limit. H. R. Heiple and B. Lewis (*J. Chem. Physics*, 1941, **9**, 584—590).—The third explosion pressure limit of H_2 and O_2 has been studied at 530—570° in Pyrex vessels coated with a thin layer of KCl and the results are discussed in conjunction with those of Oldenberg and Sommers (A., 1939, I, 325). Variations with the $H_2 : O_2$ ratio, concn. of inert gas (N_2, He, A), temp., and vessel diameter are in accord with the mechanism of Lewis and von Elbe. At lower pressures the explosion is preceded by an induction period which decreases to zero at higher pressures. The third explosion pressure limits of zero induction periods are representative of the isothermal branched chain explosion and the difference between these and those (lower) with induction periods gives a measure of the thermal effect. From the energy of activation of the reaction $H + O_2 \rightarrow OH + O$, determined at the second explosion limit, and the slope of the third explosion pressure limit–temp. curve for the reaction of zero induction period in a heavily KCl-coated vessel, the activation energy of the reaction $HO_2 + H_2 \rightarrow H_2O_2 + H$ is calc. to be 33·5 kg.-cal. per g.-mol., in accord with the val. 32·9 kg.-cal. per g.-mol. calc. directly from previous data (*loc. cit.*). It is inferred that the bond energy of H and O_2 in

HO_2 is $>65{\cdot}3$ kg.-cal. per g.-mol. and the bond energy of H and HO_2 in H_2O_2 is $<69{\cdot}5$ kg.-cal. per g.-mol. J. W. S.

Measurement of pressure and flame velocity during detonation of ethyl ether–air mixtures. E. Czerlinsky (*Z. tech. Physik*, 1940, **21**, 77—79).—The velocity of the flame in Et_2O–air mixtures has been measured during detonation in a 9-m. steel tube of 0·05 m. internal diameter, with starting pressure 4 atm., and mixture containing 70% of the air necessary for complete combustion. The flame velocity increases throughout the length of the tube until it reaches the const. detonation velocity of 1930 m. per sec. This velocity agrees with the theoretical val. The static and impact pressures in the detonation wave have been measured by means of piezo-quartz vibrators situated respectively in the side wall and in the end of the tube on which the wave impinges. Vals., static pressure 200 kg. per sq. cm., impact pressure 870 kg. per sq. cm., are approx. twice the theoretical vals. The detonation velocity is the same in C_5H_{12}–air mixtures as in Et_2O–air mixtures and is not affected by the presence of anti-knock compounds such as $PbEt_4$. O. D. S.

Mechanism of reactions involving excited electronic states. II. Reactions of the alkali metals with hydrogen. J. L. Magee and T. Ri (*J. Chem. Physics*, 1941, **9**, 638—644; cf. A., 1941, I, 18).—The reaction leading to the luminescence of Na in at. H is shown to be adiabatic, and a model potential energy surface has been constructed by the semi-empirical method and shown to be in qual. agreement with experiment. The lowest electronic states of the Na^*H_2 complex are discussed with reference to the mechanism of the non-adiabatic reaction causing quenching of the *D*-line, and it is shown that two crossing points should occur, one involving a polar state. The rate of the quenching reaction is discussed in terms of the abs. reaction rate theory. J. W. S.

Kinetics of degradation and size distribution of long-chain polymerides. R. Simha (*J. Appl. Physics*, 1941, **12**, 569—578).—The rate equations for the depolymerisation process of linear chain mols. are formulated and a general solution is given. Equations for the decrease of no. and wt. average mol. wt. with time are given for three special cases: (*a*) equal disintegration probability for all linkages independent of their position in the chain, (*b*) preferred breaking at the ends of the chain, and (*c*) equal disintegration probability for all chains independent of their length. Results for (*a*) agree with those derived statistically (A., 1940, I, 430). O. D. S.

Polymerisation of styrene in presence of carbon tetrachloride. J. W. Breitenbach and A. Maschin (*Z. physikal. Chem.*, 1940, **A**, **187**, 175—183).—Styrene (**I**) and CCl_4 react in C_6H_6 solution liberating HCl. HCl lowers the rate of polymerisation of (**I**) and reduces the mol. wt. of the polymerisation product; furthermore, this product contains Cl. The order of the CCl_4 exchange reaction is 1·1—1·4 with respect to (**I**) and 0·53—0·77 with respect to CCl_4. The mol. wt. of the Cl-free polymerisation product is 43,000—68,000 but substitution of Cl rapidly reduces it until with a product containing 22·5% of Cl the mol. wt. is ~550. Laboratory conditions for preparing CHPhMeCl from (**I**) and HCl are described. The work of Suess *et al.* (cf. A., 1937, I, 416, 523) on the polymerisation of (**I**) is criticised since their data were obtained in CCl_4 solution and therefore their theoretical deductions are unsound. C. R. H.

Polymerisation of styrene in presence of carbon tetrachloride. H. Suess (*Z. physikal. Chem.*, 1940, **A**, **187**, 184—185; cf. preceding abstract).—Polemical. C. R. H.

Kinetics of the thermal dissociation of oxalic acid in solution. I. Lütgert and E. Schröer (*Z. physikal. Chem.*, 1940, **A**, **187**, 133—148).—Comparison has been made between the decomp. of $H_2C_2O_4$ in H_2O and of $D_2C_2O_4$ in D_2O over the range 130—173°. Both reactions are of the first order, but the latter is ~20% faster than the former. The heat of activation is independent of temp. In dioxan the rate of decomp. of both acids is the same at all temp., although extrapolation to zero time suggests that the reaction with $D_2C_2O_4$ is initially faster than with $H_2C_2O_4$. This indicates an exchange between dioxan and $D_2C_2O_4$. The differences in reaction rates are ascribed to either a decrease in binding energies as a result of substituting D for H in the acid mol., or a decrease in activation energy due to H contributing more zero-point energy than D. C. R. H.

Quantitative investigations of amino-acids and peptides. VI. Function of carbonate in the synthesis of glycine from chloroacetic acid, ammonia, and ammonium carbonate. M. S. Dunn, A. W. Butler, and E. H. Frieden (*J. Physical Chem.*, 1941, **45**, 1123—1137).—The time required for production of a given quantity of glycine (**I**) at const. ratio $NH_3 : (NH_4)_2CO_3$ $\propto 1/[CH_2Cl{\cdot}CO_2H]$. The max. % yield is the same for 0·2N- as for 0·4N-$CH_2Cl{\cdot}CO_2H$. The rate of production increases with temp., the effect being more pronounced at high than at low ratios of NH_3 to $CH_2Cl{\cdot}CO_2H$. The reaction rate is slower and the yield of (**I**) is higher in presence than in absence of $(NH_4)_2CO_3$. The reaction mechanism is discussed, the conclusions reached being essentially in agreement with those of Cheronis and Spitzmueller (cf. A., 1941, II, 243). C. R. H.

Reaction of high polymerides in solution. Alkaline saponification of polyvinyl acetate. Preliminary report. I. Measurement of reaction velocity. A. Horiuchi (*Rev. Phys. Chem. Japan*, 1941, **15**, 78—85, 71—77).—The alkaline saponification of polyvinyl acetate (**I**) in aq. MeOH was investigated by determining the concn. of unchanged (**I**). There are two breaks in the course of the reaction. The rate of reaction increases with increase in [NaOH] and with increase in the degree of polymerisation of (**I**). The product of the reaction appears to be entirely polyvinyl alcohol (**II**).

I. The decrease in [NaOH] during the reaction does not correspond with the formation of (**II**), [NaOH] continuing to change after hydrolysis is complete. Saponification cannot therefore be explained thus: (**I**) + NaOH → (**II**) + NaOAc. C. R. H.

Precipitation of silver chromate. III. Gelatin medium. A. Van Hook (*J. Physical Chem.*, 1941, **45**, 1194—1203).—When Ag_2CrO_4 is pptd. in presence of gelatin there is a flat induction period associated with generation of nuclei followed by a diminishing growth period, a behaviour similar to that in aq. pptns. The data are analysed according to the method found valid for aq. pptns. (cf. A., 1940, I, 364). C. R. H.

Physico-chemical investigations on catalytic mechanism. II. Fischer–Tropsch synthesis of hydrocarbons with special reference to its reaction mechanism. S. Hamai (*Bull. Chem. Soc. Japan*, 1941, **16**, 213—228).—A mechanism of the Fischer–Tropsch synthesis of hydrocarbons is given in detail. CH_2 in the adsorbed state polymerises to long-chain hydrocarbons ($COCo_3 \rightarrow CH_2Co_3 \rightarrow Co_3{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2{\cdot}$, etc.). Approx. vals. of activation energies for reactions involved in the synthesis are given. The relationship between polymerisation and surface migration is considered. The proposed mechanism is applicable to the Fe type as well as to the Co and Ni type catalyst. A. T. P.

Sensitised chemiluminescence in solutions.—See A., 1942, I, 6.

Thermal reaction between hydrogen and oxygen. IV. Comparison of the thermal and photochemical reactions. O. Oldenberg and H. S. Sommers, jun. (*J. Chem. Physics*, 1941, **9**, 573—578).—Recent investigations of the thermal and photochemical reactions between H_2 and O_2 are reviewed critically and discussed in relation to theories of the mechanism of the reaction. It is concluded that for both cases the homogeneous reaction at higher temp. is best explained on the Bonhoeffer–Haber chain mechanism, possibly modified by the introduction of the HO_2 radical as intermediate carrier. J. W. S.

Number of quanta required to form the photographic latent image from mathematical analysis of H. and D. curve. E. W. H. Selwyn (*J. Opt. Soc. Amer.*, 1939, **29**, 518).—Geometrically identical grains in the same emulsion may have unequal sensitivities. L. J. J.

Photolysis of acetone in presence of mercury. K. W. Saunders and H. A. Taylor (*J. Chem. Physics*, 1941, **9**, 616—625).—The photochemical decomp. of $COMe_2$, alone and in the presence of liquid Hg, Hg vapour, or $HgMe_2$, in the region 2600—2900 A. has been studied at 100—275°. Comparison of the proportions of CO, CH_4, and other hydrocarbons formed in each case supports a mechanism for the Hg-sensitised reaction in which HgMe and $HgMe_2$ are formed by reaction of Me radicals with Hg and HgMe, respectively. This suggests that the HgMe radical is more stable than was previously believed. J. W. S.

Unusual reprinting by photographs in the presence of rare-earth mineral specimens. A. Keith, sen., and A. A. Keith, jun. (*J. Opt. Soc. Amer.*, 1941, **31**, 506—507).—Photographs stored face-to-back in a cardboard box were placed on top of a collection of rare-earth minerals. A no. of photographs were found to have reprinted clear images on the backs of the cards they faced. No trace of fading or change of any kind in the original photographs was found. The presence of the minerals was necessary for the occurrence of the phenomenon. A. J. M.

Photochemical chlorination of methane. M. Tamura (*Rev. Phys. Chem. Japan*, 1941, **15**, 86—97).—A thermo-analytical investigation of the chlorination of CH_4 indicates that the heat of activation of the rate-determining partial reaction $Cl + CH_4 \rightarrow CH_3 + HCl$ is $\geq 6{\cdot}2$ kg.-cal. A plausible reaction mechanism involving a third substance in the intermediate stages is offered as conforming to the data. A reaction scheme involving $Cl + CH_4 \rightarrow MeCl + H$ is adversely criticised. C. R. H.

Reversible bleaching of chlorophyll. R. Livingston (*J. Physical Chem.*, 1941, **45**, 1312—1320).—The investigation of Porret and Rabinowitsch (A., 1937, II, 471) on the reversible bleaching of chlorophyll (I) in air-free MeOH solutions has been extended. Qualitatively the results of the two investigations agree, with the exception that the half-life of bleached (I) is >10 sec. and not <1 sec. as previously found. Reversible bleaching appears to be accompanied by a relatively slow irreversible bleaching, the latter effect being $<10\%$ of the former in pure MeOH but increasing to 40% in $COMe_2$ solutions. The quantum yield of bleaching is $\sim 5 \times 10^{-4}$. Regeneration of bleached (I) followed a second-order law. The data are discussed with reference to the author's mechanism of dye photo-chemistry (A., 1941, I, 150). C. R. H.

Fluorescence of chlorophyll and photo-synthesis. F. Franck, C. S. French, and T. T. Puck (*J. Physical Chem.*, 1941, **45**, 1268—1300).—The fluorescence–time curve of a photo-synthesising leaf has three distinct phases, a rapid rise, a gradual fall, and a period of steady fluorescence. The rate and extent of the initial rise are independent of $[CO_2]$, but the rate of gradual fall in fluorescence decreases with increase in $[CO_2]$ and, additionally, with decrease in temp. Inhibition of the rate of fall of fluorescence occurs if photo-synthesis is poisoned by addition of HCN. In the third (steady) phase the fluorescence yield is const. only at low light intensities where the rate of photo-synthesis $\propto$ light intensity. In the region of light saturation the quantum yield increases. Lowering the temp. after the steady phase has been reached results in a large increase of fluorescence intensity except for very low and very high light intensities where the magnitude of the effect is small. HCN produces the same qual. effect as lowering temp. A theory explaining the induction period of photo-synthesis and the related fluorescence anomalies is presented. C. R. H.

Photographic action of canal rays. H. Lichtblau (*Physikal. Z.*, 1940, **41**, 82—86).—The action of Mo, Nd, Lu, and Hg ions of energy $\sim$ 20 e.kv. on Ilford *Q*1 and *Q*3 plates has been studied. The blackening curve for *Q*3 plates resembles the α-ray blackening curve for ordinary emulsions (cf. Kinoshita, A., 1910, ii, 375); the Schwarzschild index (Hg ions) is $0{\cdot}99 \pm 0{\cdot}05$. A different type of curve, similar to that given by visible light, is obtained with Mo and Hg ions and *Q*1 plates. The difference can be explained if the *Q*3 nuclei are developable after impact with one ion whilst the finer and less sensitive *Q*1 nuclei require several impacts. Scattering in the gelatin may also have some effect. The reciprocity law must not be assumed to hold accurately for *Q*1 plates with heavy ions. A. J. E. W.

Photochemical yield for inactivation of crystalline trypsin.—See A., 1942, III, 171.

IX.—METHODS OF PREPARATION.

Denteron–tritium reaction in fluorine.—See A., 1942, I, 5.

Double basic salts of copper and alkalis. S. Škramovský and J. Štěpán (*Časop. Českoslov. Lék.*, 1939, **19**, 4—10).—The existence of Cu K basic sulphate is confirmed and an undetermined Na salt similar to the mineral natrochalite has been obtained. The structure $M'H[Cu_2(OH)_2(SO_4)_2]$ (M′ = K or Na) of the diol compound type is probable. Dehydration at high temp. gives compounds of the type $M'_2[Cu_4O(SO_4)_4]$. F. R.

1-Hydroxyacridine as a chelate compound.—See A., 1942, II, 32.

Co-ordination compounds with furfuraldoxime as chelate group. III. Complex metallic derivatives of β(*anti*)-furfuraldoxime.—See A., 1942, II, 28.

Action of hydrogen sulphide on permanganates. I. Calcium and silver permanganates. S. Mohammad and G. S. Ahluwalia (*J. Indian Chem. Soc.*, 1941, **18**, 309—315).—H_2S bubbled through 1% $Ca(MnO_4)_2$ first ppts. $2CaO,9MnO,3MnO_2$ and then $2CaO,9MnO,MnO_2$, at which stage the purple colour is discharged; the filtrate contains $CaSO_4$ and some CaS_2O_6. Further addition of H_2S gives $CaSO_4$, CaS_2O_3, MnS, and polysulphides. With 0·5% $AgMnO_4$ $Ag_2O,3MnO,5MnO_2$ is first formed, followed by Ag_2SO_4, $Ag_2S_2O_6$, Ag_2S, MnS, and $MnSO_4$. D. F. R.

System $2CaO,SiO_2$–K_2O,CaO,SiO_2, and other phase-equilibrium studies involving potash.—See A., 1942, I, 23.

Indium. IV. Effects of certain polyhydroxy non-electrolytes on the precipitation of hydrous indium hydroxide. T. Moeller (*J. Physical Chem.*, 1941, **45**, 1235—1241).—Large amounts of fructose, *d*-glucose, or sucrose prevent pptn. of $In(OH)_3$ when alkali is added to solutions of $In_2(SO_4)_3$, $In(OH)_3$ remaining in colloidal solution as negatively charged particles. Pptn. occurs with smaller amounts of non-electrolyte, the effectiveness of these three substances in inhibiting pptn. decreasing in the order given. Regardless of the ratio of added non-electrolyte to $In^{\cdots}$ initially present, pptn. occurs at $p_H \sim 3{\cdot}41$. There is no evidence of complex formation, the data pointing only to OH' adsorption by the pptd. $In(OH)_3$. Glycerol has no inhibitory effect. C. R. H.

Radioactive thallium isotope thorium-*C*″.—See A., 1942, I, 4.

Alumino- and chromo-silicic acids. L. G. Berg and V. N. Sveschnikova (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 355—361).—The electrotitration curves of certain natural and artificial aluminosilicates suggest that the free aluminosilicic acids are extremely unstable at $p_H < 4{\cdot}5$. Chromosilicic acids are more stable, not decomp. at p_H 2. R. T.

Periodates of quadrivalent metals. P. C. Raychoudhury (*J. Indian Chem. Soc.*, 1941, **18**, 335—336).—The following *periodates* have been prepared: $CeHIO_6,H_2O$, $ThHIO_6,5H_2O$, $7TiO_2,I_2O_7$, $4SnO_2,I_2O_7$, and $3ZrO_2,I_2O_7,17H_2O$. They are all unaffected by boiling H_2O but decompose when strongly heated giving I and O_2. D. F. R.

Natural occurrence of polythionic acids.—See A., 1942, I, 76.

Electron diffraction observations of the surface reaction of hydrogen selenide on zinc oxide. M. L. Fuller and C. W. Siller (*J. Appl. Physics*, 1941, **12**, 416—419).—H_2Se reacts with ZnO to give ZnSe, but the reaction stops when the product contains $\sim$6% Se. *X*-Ray examination indicated that the product was chiefly ZnO, but electron diffraction experiments showed it to be chiefly ZnSe. It is therefore concluded that the ZnSe must form a coating on the ZnO particles. Heating to 250° causes no change in colour, Se content, or the appearance of the *X*-ray or electron photograms. At 300—350°, however, the colour darkens, the Se content decreases, and ZnO becomes the major constituent of the electron photogram. This is due to oxidation of ZnSe to ZnO and SeO_2, the latter subliming. No change occurs if the substance is heated at 450° in vac. or in N_2. The ZnSe coating and the ZnO core have the same lattice consts. as they have as individuals, indicating that no solid solution or combination occurs between the ZnO and ZnSe. A. J. M.

Allotropes of tellurium by *X*-ray diffraction.—See A., 1942, I, 12.

Complex chromium selenates. P. C. Raychoudhury (*J. Indian Chem. Soc.*, 1940, **17**, 623—626).—Two *compounds*, $Cr_2(SeO_4)_3,17H_2O$ (blue) and $Cr_2(SeO_4)_3,13H_2O$ (green), are described; cryoscopic, conductivity, and magnetic susceptibility measurements have been made. The salts differ from the green and violet selenates described by Meyer (A., 1922, ii, 70). D. F. R.

Structure, properties, and mode of formation of inorganic compounds of high mol. wt. of the type of the heteropoly-acids (phosphotungstic and metatungstic acids).—See A., 1942, I, 22.

X.—ANALYSIS.

Determination of concentration of organic and inorganic substances. E. K. Nikitin (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 75—83).—The author's method of evaluating results of turbidimetric titrations (cf. Spiridonova, A., 1937, I, 456) is expounded. R. T.

Recommended specifications for analytical reagent chemicals. W. D. Collins, H. V. Farr, J. V. Freeman, E. F. Marsiglio, P. H. Messinger, R. A. Osborn, J. Rosin, E. Wichers, and H. H. Willard (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 631—639).—Recommendations made by the Committee on Analytical Reagents, American Chemical Society, are given. Requirements and methods of testing are described for Hl, $CHCl_3$, $Cr_2(SO_4)_3$, K_2SO_4, $Co(NO_3)_2$ not low in Ni, glycerol, 8-hydroxyquinoline, $PbCO_3$, $MnSO_4$, Hg, Na_2WO_4, and ZnO. Corrections for previous specifications (A., 1933, 920) are also described for many reagents. L. S. T.

Mechanism of action of adsorption indicators. S. G. Chaudhury (*J. Proc. Inst. Chem. India*, 1941, **13**, 1—13).—A discussion of the relevant data leads to the conclusion that the indicator (dye) ions are chemisorbed on Ag halides, and that the best results are obtained when the solubility of the Ag–dye compound is of the same order as that of the Ag halide concerned. The theory proposed is in harmony with established practice in adsorption titrations and with the observed influence of adsorption indicators on the electrophoresis of Ag halide particles. F. L. U.

Preparation of stable solutions of sodium thiosulphate. J. L. Kassner and E. E. Kassner (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 655).—$CHCl_3$ prevents the growth of *Thiobacillus thioparus*. Addition of $CHCl_3$, 0·07—0·4 ml. per l., prevents decomp. of aq. $Na_2S_2O_3$ stored in rubber-stoppered bottles. 0·05N. solutions should be stored in brown glass, rubber-stoppered bottles. Sterile aq. $Na_2S_2O_3$ of p_H $\leqslant$6·2 maintains its titre for $\leqslant$16 months. L. S. T.

Colorimetric determination of phosphate. S. R. Dickman and R. H. Bray (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 665—668).—The method described uses a molybdate–HCl instead of a molybdate–H_2SO_4 solution for reduction to the blue colour by $SnCl_2$. Optimum concns. of reagents, analytical procedure, and factors affecting colour development and fading are described. $Fe^{'''}$ from $FeCl_3$ up to 15 p.p.m. does not affect colour intensity, and the increase in intensity caused by reduction of >30 p.p.m. of $Fe^{'''}$ to $Fe^{''}$ can be measured and the $[PO_4]$ determined. Other chlorides, $Al^{'''}$, $Ca^{''}$, and $Mg^{''}$ in certain concns. do not affect the method, but SO_4'', ClO_4', and NO_3' interfere with colour intensity if present in certain concns. The method is applicable to determinations of PO_4''' in soil fusions, HCl extracts of soils, H_2O analyses, plant oxidations in which the sample is extracted with HCl, oceanographic analyses, and biological determinations. L. S. T.

Application of the Reinsch test in the determination of traces of arsenic. J. G. A. Griffiths (*Analyst*, 1941, **66**, 491—492).—The Reinsch test for As is used to detect ($\leqslant$0·001 mg.) and determine small quantities of As not in strong combination with org. radicals. Cleaned pure Cu strips are boiled for 2 min. in the As solution containing 12% HCl. The grey deposits on the strips are preserved under 0·25N-HCl and compared with standards made from solutions having approx. the same concn. of other ions (SO_4, $Fe^{''}$, Na). Longer boiling times deposit more of the As and increase the sensitivity. S. B.

Colorimetric micro-determination of arsenic. A. L. Chaney and H. J. Magnuson (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 691—693).—After acid digestion of the sample, the As is distilled as $AsCl_3$ in a specially-designed still (illustrated). The distillate is used directly for development of colour after oxidation of As^{III} to As^{V} by means of KIO_3. NH_4 molybdate is added and the colour developed by addition of $N_2H_4.H_2SO_4$. The method is suitable for 1—100 μg. of As. Sb, Ge, and Se may distil with the As, but give no colour with the reagents. PO_4''', being non-volatile, does not interfere with the method. NO_3' and ClO_4' interfere with colour development and must be removed before the distillation. Details of procedure, and data for the recovery of As from tissues, are given. L. S. T.

Determination of carbon monoxide. Pyrogallol–tannic acid method as adapted to standard gas analysis equipment. F. Cook (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 661—662).—The apparatus described is designed as an accessory to standard gas analysis equipment. Using the Sayers–Yant method (cf. A., 1926, 100), and a special set of colour standards, 0·10 to 0·002% of CO can be determined in 100-c.c. samples of air. L. S. T.

Determination of small amounts of potassium. Evaluation of cobaltinitrite precipitate using ceric sulphate. B. Klein and M. Jacobi (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 687—688).—$K_2AgCo(NO_2)_6$ is pptd., decomposed by hot N-NaOH, and the liberated NO_2' titrated in acid solution by means of 0·01N-$Ce(SO_4)_2$ (*o*-phenanthroline). The method described is suitable for 0·1—0·2 mg. of $K^{'}$ and is accurate to <2%. An empirical factor is used in calculating results. Cl′ and PO_4''' must be removed, but other common ions do not interfere. The method is applicable especially to biological materials. L. S. T.

Potassium sodium cobaltinitrite precipitate. R. J. Robinson and J. D. Hauschildt (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 676—677).—The cobaltinitrite method for the determination of $K^{'}$, particularly the procedure of Schueler and Thomas (A., 1933, 688), has been investigated critically. The composition of the K Na cobaltinitrite ppt. may vary with conditions of pptn., the most important being temp. of pptn. and the [EtOH] and [$Na^{'}$] of the pptn. medium. The precision of the method for analyses carried out at the same time was usually >1%, but for those done at different times the variation was often more. In order to obtain the highest accuracy in the analysis of unknowns, standard solutions should be analysed simultaneously. L. S. T.

Determination of small amounts of beryllium in silicates. E. B. Sandell (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 674—675).—The sample (0·2 g. containing 0·0002—0·0025% Be) is fused with 1 g. of NaOH, and ice is added to the cold melt. After disintegration, the mixture is filtered, and the insol. material washed and fused again with NaOH. Be is then determined in aliquot portions of the two filtrates by means of morin (I) and by comparing with standards in ultra-violet light. The procedure described is applicable to silicates containing $\geqslant$10% of Fe, Mg, Ca, and Ti oxides, and <0·1% of Li when 0·2 g. is taken for analysis. Ca, Li, and Zn give similar but weaker fluorescences with (I) in alkaline solution. $Na_4P_2O_7$ and CN′ must be added to destroy the Ca and Zn fluorescences, respectively. Under the conditions described in the procedure none of the common elements, or Zr and Ti, gives a fluorescence. Large amounts of $Cu^{''}$ oxidise the reagent, MnO_4' must be reduced by EtOH, and CrO_4'' leads to low results, but V^{V} (0·1%), SiO_3'', PO_4''', F′, and borate do not affect the flourescence of the Be–(I) compound. L. S. T.

Detection of manganese in presence of chlorides. R. Gilbert (*Analyst*, 1941, **66**, 450).—Traces of Mn are completely co-pptd. with $Fe(OH)_3$, the ppt. is dissolved in H_2SO_4, oxidised with KIO_3 in presence of H_3PO_4, and the colour compared with that of standard $KMnO_4$ solutions. 0·2 p.p.m. Mn in KCl can be detected. S. B.

Short volumetric method for determination of iron in silicates. C. M. Nicholson (*Bull. Amer. Ceram. Soc.*, 1941, **20**, 331—334).—The acid (H_2SO_4) solution of the melt is treated in a Jones reductor and the Ti etc. is reoxidised with aërated H_2O and titrated with $Ce(SO_4)_2,2(NH_4)_2SO_4$, using *o*-phenanthroline–$Fe^{''}$ complex. The total Fe and Ti etc. is determined by omitting the aëration process. Full details of the method and its application in an assay of a magnetic separation are given. J. A. S.

Reduction method for determining titanium dioxide. H. Skolnik and W. M. McNabb (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 672—673).—The TiO_2 (0·05—0·5 g.) is dissolved in conc. H_2SO_4 containing $(NH_4)_2SO_4$, and the diluted solution (10% H_2SO_4) is treated with 2 g. of 30-mesh Zn until a lilac colour develops. It is then poured through a funnel, the stem of which is packed with 30-mesh Zn, into Fe^{III} alum solution, and the $Fe^{''}$ formed titrated with aq. $KMnO_4$. Comparison with the cupferron and basic chloride gravimetric methods showed average deviations of −0·08 and −0·03%, respectively.

Details of procedure and precautions to be observed are recorded. L. S. T.

Direct determination of vanadium in presence of titanium and iron. S. S. Cole and C. A. Kumins (*Bull. Amer. Ceram. Soc.*, 1941, **20**, 329—331).—The acid (HCl) solution is reduced with Ag and the Fe determined by titration at 20° with aq. $Ce(SO_4)_2$ and *o*-phenanthroline (**I**) as indicator. V is determined in the H_2SO_4 solution (after removal of HCl) by adjusting to V^{IV} with $Ce(SO_4)_2$ or $FeSO_4$ solution to the red colour of (**I**), boiling to destroy the indicator, and immediately titrating with $KMnO_4$. The determination of Ti in presence of V and Fe is improved by reducing with Zn or lightly amalgamated Zn and then titrating with $Fe_2(SO_4)_3$,$(NH_4)_2SO_4$ (NH_4CNS as indicator) at $<90°$, or (less preferably) with $KMnO_4$, making allowances for the V^{IV} content. J. A. S.

Determination of antimony and its separation from tin and lead by means of alkali thiocyanates. H. N. Ray (*J. Indian Chem. Soc.*, 1940, **17**, 586—587).—25—30 c.c. of saturated aq. NH_4CNS are added to the boiling solution (125—150 c.c.) containing ~0·1 g. of Sb; HNO_3 and H_2SO_4 must be absent. Boiling is continued for 1 min., and the pptd. Sb_2S_3 allowed to settle during 5 min.; the liquid is diluted to 300 c.c., and the ppt. is collected on a Gooch crucible, washed successively with aq. H_2S, hot H_2O, CS_2, and EtOH, and dried at 200—300° for 2 hr. Sn^{II} tends to co-ppt. with the Sb; Sn^{IV} and Pb do not interfere unless present in excess, when double pptn. is advisable. Test data show that the method gives low results. A. J. E. W.

Organic reagents and methods involving their use. Precipitation of bismuth, zinc, and vanadium with salicylaldoxime. J. F. Flagg and N. H. Furman (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 663—665; cf. A., 1940, I, 445).—$Bi^{...}$ is pptd. completely by salicylaldoxime (**I**) at p_H <7·2. The ppt. coagulates and filters well, but loses wt. steadily at 110°. It must be converted into Bi_2O_3 by ignition in presence of NH_4NO_3. $Ag^{\cdot}$ and $Zn^{..}$ are not pptd. with $Bi^{...}$ when p_H is <9. $Zn^{..}$ is pptd. quantitatively by (**I**) at p_H 7—8, and the $Zn(C_7H_6O_2N)_2$ first formed is converted into $ZnC_7H_6O_2N$ (**II**) by heating for 10 min. at 90—100° (cf. A., 1938, I, 323). (**II**) can be weighed after drying at 110° for 1 hr., and the theoretical factor used. $Cd^{..}$ is pptd. under conditions similar to $Zn^{..}$, but the ppt. is more difficult to filter, and appears to be a variable mixture of $Cd(C_7H_6O_2N)_2$ and $Cd(C_7H_5O_2N)$. H_3VO_4 is pptd. incompletely by (**I**) in presence of H_2SO_4; the approx. formula of the ppt. is $C_{21}H_{21}N_3O_{10}V_2$. 0·02 mg. of V as H_3VO_4 in 15 ml. of solution can be detected by adding (**I**) and $CHCl_3$, and shaking. The $CHCl_3$ layer is coloured orange to reddish-orange. $Fe^{...}$, but not Mo or Cr, gives a similar reaction. L. S. T.

XI.—APPARATUS ETC.

Radiation pyrometer. J. Strong (*J. Opt. Soc. Amer.*, 1939, **29**, 520—530; cf. A., 1940, I, 394).—In the instrument described, a narrow band of λλ centred at 8·8 μ. is isolated by means of a multiple quartz-plate residual ray apparatus. The band falls within the 8—14 μ. region of high atm. transparency, enabling the pyrometer to be used for measurement of surface temp. of remote objects. Temp. in the range 0—100° can be determined to 0·1°. L. J. J.

Temperature correction methods in calorimetry. A. King and H. Grover (*J. Appl. Physics*, 1941, **12**, 557—568).—Theoretical. Methods of temp. correction for heat loss to the surroundings are investigated for two types of calorimetric experiment, that in which the heat is supplied to the calorimeter over a definite short time, and that in which the heat supply continues over an indefinite long time, *e.g.*, in bomb calorimeter experiments. Methods of correction used by previous authors are generalised for experiments of the first type. A new and more exact correction method for experiments of the second type is derived and a graphical method of performing the correction is described. Previously used methods are in error by 0·27—0·17%. O. D. S.

Measurement of the radiation of hot flame gases with the photo-cell. R. Mecke and H. Kempter (*Z. tech. Physik*, 1940, **21**, 85—88).—The spectral distribution from 800 to 1000 mμ. and the total intensity through infra-red filters cutting off λλ <846, 873, and 1002 mμ., respectively, of radiation from the non-luminous Bunsen flame have been compared with the corresponding radiation from an Osram lamp by means of a Cs photo-cell. The principal emission band in this region is the 942 mμ. band of H_2O. The sensitivity of the cell is sufficient for investigation of the radiation from the hot gases at temp. down to 1000°. O. D. S.

Precision refractometer. J. V. Hughes (*J. Sci. Instr.*, 1941, **18**, 234—237).—A refractometer permitting measurement of n to 0·00001 is described. The sample has two faces smooth ground approx. to a right angle, and is sealed between two 45°–45°–90° prisms by a liquid of similar n. Determinations occupy less time than with the Pulfrich refractometer if the time devoted to the prep. of the specimen is included. A. A. E.

Quantitative spectral analysis with composite electrodes. W. Ehrenberg (*Naturwiss.*, 1940, **28**, 667).—The fact that the intensity ratio of spectral lines depends on the form of the electrodes makes it difficult to use samples of indefinite form, such as splinters and shavings. These can only be used for quant. spectral analysis if it is possible to make the light conditions independent of the form of the test piece. This can be done by combining the irregular specimen with a regular electrode of considerably greater cross-section, and of indifferent material. The same substance is used for the other electrode. The test piece is pressed into the indifferent electrode and does not project from it. The spectrum may be evaluated by the usual methods using two standardising substances which have a similar shape to the test piece, or by a new method which requires only one standard. A. J. M.

Photo-cells and photo-electric colorimeters. S. Roy (*J. Proc. Inst. Chem. India*, 1941, **13**, 14—27).—A general survey. F. L. U.

Photo-electric cells for the visible spectral range. P. Görlich (*J. Opt. Soc. Amer.*, 1941, **31**, 504—505).—A photo-electric cell of high sensitivity in the visible range of λλ <6000 A. has been constructed, using a cathode consisting of alloys of an alkali metal and a metal of lower conductivity, *e.g.*, Bi or Sb, in conjunction with Cs_2O. The alloy alone has a selective max. between 4000 and 5000 A., whilst a Cs_2O cathode has a max. at 7500—8500 A. When a Cs_2O cathode is overlaid by an alloy layer there is an overall sensitivity with the two max. Electrons from the deeper Cs_2O layer are selectively transmitted through the alloy layers. The metallic base in an alloy cathode affects the sensitivity only if its transverse conductivity is too low. The combinations Cs–Sb, Cs–Bi, Rb–As, Na–B, and K–Si have been investigated, but only the first two give a high gain of quanta. A. J. M.

Push-pull photo-electric photodensitometer for determining fine structure in ultra-violet absorption spectra. J. R. Loofbourow (*J. Opt. Soc. Amer.*, 1939, **29**, 535—537).—The instrument described is used for the determination of fine structure from match-point spectrum photographs. L. J. J.

Errors in spectrophotometry due to imperfect collimation and finite size of light source. G. O. Langstroth (*J. Opt. Soc. Amer.*, 1939, **29**, 381—386).—The relation between the optical density and the transmission of a solution, for the case of a slit source of light, a collimating lens, and an absorption cell containing the solution, differs from the Lambert–Beer relation by a factor determined by the absorption coeff. and n of the solution, the cell depth, the distance of the source from the principal focus of the lens, the dimensions of the source, and the position of the lens transmitting the light. Imperfect or no collimation introduces relatively slight errors. L. J. J.

Use of ultra-violet source for interferometer measurements of thickness of thin metallic films. J. C. Clark and N. L. Fritz (*Rev. Sci. Instr.*, 1941, **12**, 483—484).—The method described uses λ 3654 A. filtered from the Hg arc spectrum as a light source for the Michelson interferometer. The shorter λ produces a proportionally greater fringe shift, and film thicknesses of 150—600 A. can be satisfactorily measured. D. F. R.

High-intensity *X*-ray monochromator. P. Kirkpatrick (*Rev. Sci. Instr.*, 1941, **12**, 552—554).—A monochromator for concentrating radiation λ 0·71 A. has been made by disposing about a common symmetry axis a group of 8 rock-salt crystals each plastically deformed between two curved metal surfaces and ground to the spindle surface curvature required for focussing radiation from a point source to a point image. The max. monochromatic intensity at the focus

is > that of the total radiation from the Mo target source when received directly at the same location. D. F. R.

X-Ray photon efficiency of a multiplier tube. J. S. Allen (*Rev. Sci. Instr.*, 1941, **12**, 484—488).—The design and operation of a 12-stage electrostatic multiplier tube as a photon counter are discussed. The tube has a pure Ta photoelectric surface, the multiplying electrodes being covered with oxidised Be. With 300 v. between successive electrodes the tube has a background counting rate of 3—5 pulses per min. and records about one photon in 500 at λ 1 A. The multiplication is ~18,000. D. F. R.

Formula for the reduction of Lummer plate fringes. D. J. Behrens (*J. Sci. Instr.*, 1941, **18**, 238—239).—A simple formula giving vals. of apparent fractional order-separations in terms of the positions of the fringes can readily be applied by the use of tables of reciprocals. It is valid up to the centre of the fringe-system and is subject to error of only >0·1%. A. A. E.

Measuring microscope. Technique for measuring vertical distances up to several centimetres with a precision of 0·00005 cm. G. H. Wagner, G. C. Bailey, and W. G. Eversole (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 658—659).—The instrument has a range of 16 cm. Details of construction, testing, and use are given. L. S. T.

Voltammetric determinations and amperometric titrations with a rotating micro-electrode of platinum wire. H. A. Laitinen and I. M. Kolthoff (*J. Physical Chem.*, 1941, **45**, 1079—1093).—The investigation described in the preceding paper (A., 1942, I, 65) has been extended to measurements made with two types of rotating electrode. For the reduction of O_2, Ag^+, and Br the diffusion current ∝ concn. The larger diffusion currents obtained permit the determination of electro-reducible and -oxidisable substances at much lower concns. than with the stationary electrode. The amperometric titration of 0·001N-As_2O_3 with 0·0017M-$KBrO_3$ and of 0·001M-$AgNO_3$ with 0·0111N-KCl is described. Data for the oxidation of $Fe(CN)_6''''$ indicate that the thickness of the effective diffusion layer remains const. for slight temp. changes, thus differing from the stationary electrode. C. R. H.

Effect of the chemical durability of glass on the asymmetry potential and reversibility of the glass electrode.—See A., 1942, I, 24.

Apparatus for high-speed stirring. Effect of flask design and other factors on stirring. A. A. Morton and D. M. Knott (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 649—653).—Directions for constructing a laboratory stirring apparatus which can operate at ~11,000 r.p.m. and be mounted on an ordinary stand are given. Efficiency of mixing is increased by using flasks with deep vertical creases. Relative efficiencies of different flasks and of stirrers of the propeller type have been compared by measurements of the heat evolved in the oxidation of PhMe or xylene by $KMnO_4$. Obstructions other than the vertical creases in the sides of the flask reduce efficiency. L. S. T.

Shaping lathe for graphite electrodes used in spectrochemical analysis. K. R. Majors and T. H. Hopper (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 647—648).—Details of construction and operation are described and illustrated. L. S. T.

Water-jacketed fraction receiver. R. S. Towne, E. E. Young, and L. T. Eby (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 626).—The receiver described and illustrated can be used with ordinary laboratory stills, and permits many fractions to be collected without disturbing the pressure in the still. L. S. T.

Alloys for instruments. O. F. Hudson (*J. Sci. Instr.*, 1941, **18**, 211—216).—Characteristics and suitability for instrument construction of various alloys of Al, Mg, Be, Cu, Fe, and Ni are discussed. A W–Ni (5%)–Cu (5%) alloy, *d* 16·5, is suitable for Ra bombs. The composition of manganin is not crit.; variations in Mn of 9—13 and in Ni of 1·5—4% are permissible. A. A. E.

Whirling arm for producing small differences of pressure, its calibration by aid of a smoke manometer, and its application to measurements of surface tension. G. F. C. Searle (*Proc. Physical Soc.*, 1941, **53**, 681—694).—A description of the construction, use, and mathematical principles of the device, with measurements for soap solution. N. M. B.

XIII.—GEOCHEMISTRY.

Physical condition of the planets. (Sir) J. Jeans (*Proc. Roy. Inst.*, 1941, **31**, 437—459).—A lecture.

Natural occurrence of polythionic acids. S. H. Wilson (*Nature*, 1941, **148**, 502—503).—Of the 17 acid waters examined from 7 areas in the thermal region of the North Island of New Zealand only 2 contained polythionates. One is the "Black Pool" at Ruahine, near Rotorua, and the other the "Black Geyser" at Ketehahi Hot Springs, which contains 99 mg. of S_4O_6'' and 66 mg. of S_5O_6'' per l. H_2O from the "Middle Crater" on White Island contains 170 mg. of S_4O_6'' per l. (cf. *Proc. Chem. Soc.*, 1911, **27**, 10). L. S. T.

Flow of air through rocks at low rates. A. H. Nissan (*Nature*, 1941, **148**, 503).—Darcy's law is not followed when the rock is impervious and the velocity of the flowing air is low in consequence. L. S. T.

Helium method for determining the age of rocks. N. B. Keevil (*Nature*, 1941, **148**, 445—446).—The wide variations shown in the ratio of experimental age or He index to the expected age from mineral to mineral and from rock to rock are attributed to non-uniform loss of He. He retentivities for various rocks and minerals are tabulated. In its present stage of development, the He method is untrustworthy as a means of geological correlation. L. S. T.

Origin of magnetite deposits of Mayurbhanj State, Orissa. S. C. Chatterjee (*Current Sci.*, 1941, **10**, 334—335).—The deposits are not derived from pyroxenes or olivine, since they do not show any genetic association with altered rocks. The magnetite is probably of primary magmatic and high-temp. metasomatic origin (cf. Alling, A., 1939, I, 498). A. J. E. W.

Post-mineralisation fissuring at Ashanti mine. J. L. Farrington (*Bull. Inst. Min. Met.*, 1941, No. 447, 15 pp.).—The general geology and the fissuring are described. Most of the fissuring took place probably after introduction of the quartz, which bears the ore-bodies. L. S. T.

Swelling of clay.—See A., 1942, I, 20.

Sulphide and carbonate constituents of coal seams. A. Bray (*Proc. Geol. Assoc.*, 1941, **52**, 183—193).—Pyrite and carbonate minerals are present in all coal seams. The sulphide occurs in the seams as lenses and nodules of primary origin which were formed at the time the coal measure vegetation was accumulating and before pressure became effective. The primary type originated in the replacement of plant tissues, microspores, and macrospores, and was brought about by biochemical decay. Secondary or redeposited pyrite is found chiefly in fissures along which solutions could pass, and is especially common associated with carbonate minerals in the cleat fissures. It is suggested that the redeposited type was obtained from the dissolution and redistribution of the primary pyrite. There was a long time interval between the deposition of the two types. Both the primary and secondary sulphides are pyrite. Marcasite appears to be rare in coal seams. The carbonates of coal seams are chiefly ankerite or dolomite, or occasionally calcite. Cryptocryst. SiO_2 is also frequently present. These minerals are usually found in the cleat spaces and their order of formation was pyrite, ankerite or dolomite, and finally SiO_2, or a further deposition of ankerite or dolomite. The first crystals to form were in large, well-shaped rhombs. R. B. C.

New physical methods applied to the problem of rational location of oil wells. J. G. Dorfman and L. A. Sergeev (*J. Physics U.S.S.R.*, 1940, **3**, 393—400).—When certain simplifying assumptions are made, the positions of wells in a uniform geometric net with const. spacing can be arrived at for the best exploitation of oil-fields, but this does not take into account the inhomogeneity of the filtering capacity of the oil reservoir rock. The filtering permeability of a rock can be determined by a comparison method, described, which is based, in principle, on the bridge method of determining electrical resistance. An electric model is described, by means of which it is possible to find the best location for new wells in a field already partly tapped, and the interference of one well with another. The model assumes no variation of the extent of the field with time, and the presence of gas bubbles in the oil is not taken into account. A. J. M.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MARCH, 1942.

I.—SUB-ATOMICS.

Intensities of a triplet of Si III in early-type spectra. I. H. Abdel-Rahman (*Month. Not. Roy. Astron. Soc.*, 1941, **101**, 312—316).—The total intensities of the three lines of a Si III triplet, measured in 31 early-type stars, are nearly ∝ the square roots of the theoretical emission intensities. Present theory indicates a discrepancy which may possibly be explained on the assumption of a large damping const. The relative intensities of the lines are discussed with regard to luminosity and total absorption. W. J.

Spectroscopy in the vacuum ultra-violet. J. C. Boyce (*Rev. Mod. Physics*, 1941, **13**, 1—57).—A review of spectrographic technique and recent data on at. and mol. spectra, spectra of solids, and astrophysical applications in the vac. ultra-violet. L. J. J.

Quantitative spectral analysis with composite electrodes.—See A., 1942, I, 74.

Absorption of light by sodium vapour. D. C. Stockbarger (*J. Opt. Soc. Amer.*, 1940, **30**, 362—364).—Apparatus suitable for class demonstration of the Na principal series is described. The absorption tube is of stainless steel, and the pressure used is atm., or a little above. A. J. M.

Spark spectrum of europium, Eu II. H. N. Russell, W. Albertson, and (Miss) D. N. Davis (*Physical Rev.*, 1941, [ii], **60**, 641—656).—An analysis and interpretation of available data (cf. King, A., 1939, I, 502). Identifications of 156 levels and data, and classifications of 467 lines, are reported; ~2000 lines remain unclassified. The strongest lines of Eu II arise from transitions based on the ground level $f^7 {}^8S^o$ of Eu III. Series of three consecutive $^9S^o$ and $^7S^o$ terms give 11·21 v. for the ionisation potential. Zeeman patterns for 459 lines and g vals. for 118 levels are tabulated; those for the low levels agree with theory, but the higher levels are much perturbed. Patterns for a few lines of Eu I and Eu III are given; the latter confirm that the ground state is $^8S^o$. N. M. B.

Formula for the reduction of Lummer plate fringes.—See A., 1942, I, 75.

Zeeman effect in the rhodium arc spectrum at high fields. J. P. Molnar and W. J. Hitchcock (*J. Opt. Soc. Amer.*, 1940, **30**, 523—535).—The Zeeman effect for Rh I has been photographed in fields up to 94,000 gauss. Data are given for 446 lines and vals. are calc. for nearly all the known low and middle spectral terms of Rh I. For terms arising from the low, even configurations, the g vals. agree with those given by LS coupling formulæ. This holds for $J = 4\frac{1}{2}$ and $3\frac{1}{2}$, but for terms having $J = 2\frac{1}{2}$ or $1\frac{1}{2}$ there is considerable deviation due to a perturbation of the terms in the d^8s configuration by those in the d^9 configuration. The g sum rule is, however, valid when the terms from the two configurations are taken together. For the odd configurations the assignment of L and S quantum nos. to levels is difficult because the coupling is intermediate. The g sum rule does not hold satisfactorily, the vals. of g lying between those predicted by LS and jj coupling formulæ. A list of 14 additional terms is given. Old term vals. have been recalc. on the basis of new λ data. A. J. M.

Push-pull photo-electric photodensitometer for determining fine structure in ultra-violet absorption spectra.—See A., 1942, I, 74.

X-Ray photon efficiency of a multiplier tube.—See A., 1942, I, 75.

Mechanism of electrical discharges in gases of low pressure. M. J. Druyvesteyn and F. M. Penning (*Rev. Mod. Physics*, 1941, **13**, 72—73; cf. A., 1941, I, 357).—Corrections. L. J. J.

At. wt. of fluorine calculated from density and X-ray data. C. A. Hutchison and H. L. Johnston (*J. Amer. Chem. Soc.*, 1941, **63**, 1580—1582).—From available X-ray and ρ data on LiF and calcite the at. wt. of F is computed as 18·9935±0·0015 in agreement with gas-density determinations on CF_4 and SiF_4 but not with the mass-spectrographic val. W. R. A.

Mol. wt. of potassium bromide and at. wt. of silver, bromine, and potassium. R. K. McAlpine and E. J. Bird (*J. Amer. Chem. Soc.*, 1941, **63**, 2960—2965).—The mean mol. wt. of KBr from the ratio $KBrO_3$: KBr is 119·01. The ratio KBr : Ag is 1·103191 when the KBr is produced by thermal decomp. of $KBrO_3$ and 1·103195 when KBr is prepared by the action of Br on $K_2C_2O_4$. The at. wts. of Ag, Br, and K are, therefore, 107·879, 79·915, and 39·096, respectively. W. R. A.

Isotopic weights of sulphur and titanium. T. Okuda and K. Ogata (*Physical Rev.*, 1941, [ii], **60**, 690—691).—With a Bainbridge–Jordan mass-spectrograph measurements by the doublet method gave the following isotopic wts.; calc. packing fractions are shown in parentheses: ^{32}S 31·98089± 0·7 × 10^{-4} (−5·98±0·02), ^{34}S 33·97711±3·3 × 10^{-4} (−6·73± 0·10), ^{46}Ti 45·96612±9·5 × 10^{-4} (−7·36±0·21), ^{47}Ti 46·96473± 9·5 × 10^{-4} (−7·50±0·20), ^{48}Ti 47·96332±4·8 × 10^{-4} (−7·46± 0·10), ^{49}Ti 48·96479±5·3 × 10^{-4} (−7·19±0·11), ^{50}Ti 49·96229±3·8 × 10^{-4} (−7·54±0·08). The calc. chemical at. wt. of Ti is 47·88±0·04, in good agreement with the international val. 47·90. N. M. B.

Scattering of protons by protons from 200 to 300 ke.v. G. L. Ragan, W. R. Kanne, and R. F. Taschek (*Physical Rev.*, 1941, [ii], **60**, 628—640; cf. Hafstad, A., 1938, I, 168).—With special arrangements of scattering chamber and proportional counters, measurements as a function of energy and of angle give results in good agreement with Breit's calculations (cf. A., 1939, I, 395) based on a square-well proton–proton interaction potential of radius e^2/mc^2 and depth 10·500 Me.v. Full data are tabulated and plotted. N. M. B.

Action of fast hydrogen ions on lithium chloride. J. D. Craggs and J. F. Smee (*Nature*, 1941, **148**, 531).—Bombardment of targets of LiCl, prepared by fusion of LiCl,nH$_2$O on to a Mo surface, with H ions ($^1H^+$ and $^2H^+$ in the ratio of ~1 : 1) at 100 μa. and 600 kv. changes the colour to purple in regions struck by the beam. With an increase in c.d. the colour intensity increases and the centre of the bombarded area is black. The effect is superficial, and exposure to air for 3—5 min. restores the white colour. LiOH targets turn grey on bombardment. The purple colour may be due to a subchloride. Bombardment of CaF_2 produces a purple colour stable for ∢4 days. L. S. T.

Chemical effects of the nuclear isomeric transition in bromine; evidence for atomic bromine and some of its properties. D. de Vault and W. F. Libby (*J. Amer. Chem. Soc.*, 1941, **63**, 3216—3224).—The nuclear isomeric transition of radio-Br of half-life 4·5 hr. (**I**) to radio-Br of half-life 18 min. (**II**) has been investigated by keeping compounds containing (**I**) under various conditions for ~2 hr. and then carrying out chemical separations on them. The transition usually induces a shower of electrons from the Br atom. Thus, if the mol. containing the Br is in the gaseous state it will be decomposed by the resulting large positive charge. (**II**) is ejected and quickly neutralised by electron transfer on collision with neutral mols., yielding HBr, Br_2, or free Br atoms. The Br atoms are not very sol. in H_2O or conc.

H_2SO_4 and do not react readily with org. compounds such as EtBr. In liquid phases substitution reactions occur as a result of the cage effect keeping the highly-charged Br in contact with neighbouring mols. for a longer time so that they are broken up by the charge and the fragments may combine with the Br. ~25% of (II) ejected from org. compounds in the gas and in the liquid will interchange with Br_2 or react with reducing agents, but is not extracted by H_2O, whereas another portion is readily extracted by H_2O. The amount of (II) which goes into or remains in org. form is reduced to a min. in the gaseous phase or by adding EtOH or NH_2Ph to liquids. Substitution into CS_2 has been observed and substitution into CCl_4 occurs from either Br_2 or alkyl bromides. The products from the gas phase at 21 mm. pressure show no preference for either negative or positive charged plates. The extraction from BrO_3' depends slightly on the presence of Br' ions and this may indicate that an intermediate form is involved in this extraction. W. R. A.

Artificial radioactive isotopes of thallium, lead, and bismuth. K. Fajans and A. F. Voigt (*Physical Rev.*, 1941, [ii], **60**, 619—625; cf. A., 1940, I, 384).—Deuteron bombardment of Tl gives a low-intensity 65-min. Pb isotope (unassigned) emitting γ-rays and 1·00-Me.v. electrons. Deuteron and neutron bombardment of Tl gives an activity of half-life $3·5 \pm 0·5$ years (provisionally ^{206}Tl) emitting β-particles of max. energy 0·87 Me.v. The 52-hr. Pb (unassigned) from the deuteron bombardment of Tl emits 450-ke.v. γ-rays, 370-ke.v. conversion electrons, and 95-ke.v. X-rays. The half-life of 3-hr. Pb (cf. Krishnan and Nahum, A., 1941, I, 3) is measured as $3·32 \pm 0·03$ hr. and its β-ray energy as 0·70 Me.v. The 6·4-day Bi emitted 1·1-Me.v. γ-rays and 0·86-Me.v. electrons. Excitation functions for 3-hr. Pb and 6·4-day Bi are measured; that for the latter indicates production by a (d, n) reaction (see following abstract). A 10-min. positron activity in Pb and 18-hr. Bi activity are not confirmed. N. M. B.

Use of uranium lead in the assignment of artificial radioactive isotopes. K. Fajans and A. F. Voigt (*Physical Rev.*, 1941, [ii], **60**, 626—627; cf. preceding abstract).—In order to establish the origin of the 3·3-hr. Pb and 6·4-day Bi, ordinary Pb and U-Pb were bombarded with deuterons and the intensities of the resulting activities were compared with the abundances of the isotopes. Results indicate that 3·3-hr. Pb is produced from ^{208}Pb by the reaction ^{208}Pb (d, p) ^{209}Pb, and 6·4-day Bi from ^{206}Pb, the assignment depending on the type of reaction, probably ^{206}Pb (d, n) ^{207}Bi. N. M. B.

Momentum loss of heavy ions. J. H. M. Brunings, J. H. Knipp, and E. Teller (*Physical Rev.*, 1941, [ii], **60**, 657—660; cf. A., 1941, I, 285).—The capture and loss of electrons in collisions is characterised by the velocity V_c within the ion of the participating electron or electrons having velocity V, and $V_c = \gamma V$. In order to calculate the momentum loss of a heavy ion in its passage through matter the charge of the ion as a function of its velocity is estimated on the assumption that V_c is that of the energetically most easily removable electron, and also that V_c is that of the outermost electron. Both estimates are based on the Fermi–Thomas model, and in the first case γ increases with at. no. and in the second case decreases. The probable val. of V_c is between these extremes. N. M. B.

Resonance level of mercury at negative energy. M. Kimura (*Physical Rev.*, 1941, [ii], **60**, 688—689).—Scattering cross-sections of Hg for C, D, and I neutrons were measured by the method of back scattering. Vals. are calc., with certain specified assumptions, for assumed resonance levels at −0·3, −0·1, and −0·05 e.v. The −0·1 e.v. val. best fits experimental results. N. M. B.

Long-lived activity of rhodium. O. Minakawa (*Physical Rev.*, 1941, [ii], **60**, 689—690).—Powdered Rh was bombarded with slow neutrons from Be + D and fast neutrons from Li + D. The slow neutrons gave the previously known 44-sec. and 4-min. activities; the fast neutrons gave a 210 ± 6-day activity emitting negative and positive electrons, with intensity ratio 1·2, and γ-rays. The upper energy limit of the mixed β-rays was $1·1 \pm 0·1$ Me.v. Results indicate that the long-lived activity is ^{102}Rh produced by ^{103}Rh $(n, 2n)$ ^{102}Rh, and as it emits positive or negative electrons goes over to ^{102}Pd or ^{102}Ru, respectively. N. M. B.

Tracks of nuclear particles in photographic emulsions. M. M. Shapiro (*Rev. Mod. Physics*, 1941, **13**, 58—71).—A review of results obtained by the direct photographic method of recording nuclear tracks. L. J. J.

Relativistic field theories of elementary particles. W. Pauli (*Rev. Mod. Physics*, 1941, **13**, 203—232).—Mathematical. A review of field theories for particles with spin 0, ½, and 1. The results are applied to the radiationless collision of charged particles, the Compton effect, "bremsstrahlung," and pair generation. L. J. J.

II.—MOLECULAR STRUCTURE.

Afterglow in mercury vapour. (Miss) M. B. M'Ewen (*Nature*, 1941, **148**, 532—533).—An explanation involving mol. rather than at. ions is discussed. L. S. T.

Absorption spectrum of suspensions of carbon black.—See A., 1942, I, 56.

Transmission of infra-red radiation through fog. P. N. Smith and H. V. Hayes (*J. Opt. Soc. Amer.*, 1940, **30**, 332—337).—Observations formerly made in connexion with fogs over inland waters have now been carried out at sea. It is found that it is possible to detect and measure the energy of infra-red radiation of λ 3 μ. or more through the worst conditions of fog and ambient illumination to distances considerably > the limit of visibility. Longer rays suffer less attenuation in passing through fog than the shorter visible or nearly visible rays. A. J. M.

Improved computations on conjugation and hyperconjugation. R. S. Mulliken and C. A. Rieke (*J. Amer. Chem. Soc.*, 1941, **63**, 1770—1771).—Mathematical. Observed hyperconjugation shifts in ultra-violet spectra have been calc. by a method which is discussed. W. R. A.

Electronic spectra of polyatomic molecules. H. Sponer and E. Teller (*Rev. Mod. Physics*, 1941, **13**, 75—170).—A comprehensive survey. The theory of electronic states is discussed with reference to selection rules, vibrations and the Franck–Condon principle, coupling between vibration and electronic motion, anharmonicity and predissociation, rotational structure, and isotopic effect. The theory is applied to typical examples: linear mols. (Hg halides, C_2N_2, and N_2O), tetrahedral mols. (OsO_4 and RuO_4), CH_4 derivatives (MeI, CH_2O, and NH_2Me), and C_6H_6 and derivatives. In appendices are tabulated data and observations for all available investigations on the gaseous phase since 1936 and a complete bibliography of original papers. N. M. B.

Metallic reflexion by compressed crystalline powders. J. A. Sanderson (*J. Opt. Soc. Amer.*, 1940, **30**, 566—567).—Powdered marble, $CaSO_4$, plaster of Paris, gypsum, talc, K_2CrO_4, and $AgNO_3$, when pressed into plates under a pressure of ~40,000 lb. per sq. in., reflect strongly in the infra-red at λλ characteristic of their functional groups. It is suggested that such plates could be used to investigate the optical properties of substances not available in the form of large crystals. A. J. M

Infra-red absorption and reflexion spectra of KHF_2 and KDF_2. J. A. A. Ketelaar (*J. Chem. Physics*, 1941, **9**, 775—776).—Measurements made between 1 and 16 μ. are in accord with previous results for part of this range (A., 1940, I, 282). It is shown, however, that the max. at 1222 and 1450 cm.$^{-1}$ in absorption and 1238 and 1490 cm.$^{-1}$ in reflexion are both fundamentals, whilst the three other pairs of bands of decreasing intensity at <3500 cm.$^{-1}$ are combination frequencies of these with a frequency of 560—600 cm.$^{-1}$ The bands above this limit are due to second harmonics of the 5099 and double 3730 cm.$^{-1}$ fundamentals and their combinations with the 560 cm.$^{-1}$ frequency. The spectrum of KDF_2 is similar, with a shift of the fundamentals to 891 and 1046 cm.$^{-1}$ in reflexion, but the 560 cm.$^{-1}$ frequency is unchanged, and is therefore the symmetrical frequency. As the spectra of KHF_2 and $RbHF_2$ are almost identical, the other frequencies are due to the HF_2 group, which resonates between the structures FH F and F HF. J. W. S.

Molecular configurations in rotational isomerism. S. Mizushima, Y. Morino, and M. Takeda (*J. Chem. Physics*, 1941, **9**, 826).—Priority in suggesting that the co-existence of the *trans* and gauche forms of $(CH_2Cl)_2$ and similar mols. accounted

for the no. of depolarised lines in their spectra is claimed (cf. Edgell and Glockler, A., 1941, I, 242). W. R. A.

Ultra-violet absorption spectra of organic molecules. II. Effect of substituent groups on the absorption of diphenyl. (Miss) B. Williamson and W. H. Rodebush (*J. Amer. Chem. Soc.*, 1941, **63**, 3018—3025).—The effect of type and position of substituents in the diphenyls on the ultra-violet spectrum has been investigated using F, Cl, Br, I, OH, OMe, CO_2Me, NH_2, and NO_2 disubstituted derivatives. With increasing size of group in the *o*-positions the departure from coplanarity increases. Good agreement between possible resonance structures and vals. for extinction coeff. and λ of max. absorption has been obtained. W. R. A.

Absorption spectrum of diphenylene. (Miss) E. P. Carr, (Miss) L. W. Pickett, and (Miss) D. Voris (*J. Amer. Chem. Soc.*, 1941, **63**, 3231—3232).—Diphenylene in C_6H_{14} gives well-defined bands from 25,000 to 32,000 cm.$^{-1}$ and a very intense band with max. at 40,250 cm.$^{-1}$ The spectrum has similarities to those of $C_{10}H_8$ and fluorene. W. R. A.

Ultra-violet absorption spectrum of pyrimidine. F. M. Uber (*J. Chem. Physics*, 1941, **9**, 777—779).—Wave nos. of 112 absorption bands of pyrimidine vapour in the 2700—3300 A. region have been measured and are classified into four categories according to intensity. Assignments of individual bands into a no. of series have been made and all prominent series show spacings of approx. 1014 cm.$^{-1}$ Other characteristic $\nu\nu$ are 613, 669, and 680 cm.$^{-1}$ W. R. A.

Near ultra-violet absorption spectrum of monochlorobenzene. H. Sponer and S. H. Wollman (*J. Chem. Physics*, 1941, **63**, 816—825).—The absorption spectrum of PhCl (symmetry C_{2v}) has been studied in the first order of a 3-m. grating spectrograph at 2750—2400 A. The band system corresponds with an electronic transition $A_1 \rightarrow B_1$ with the transition moment lying on the mol. plane perpendicular to the C–Cl linking. The 0,0 band appears strongly. Several progressions involving totally symmetrical vibrations have been found. " Forbidden " bands appear owing to the excitation of the non-totally symmetrical vibration ($\epsilon_g'' = 606$ cm.$^{-1}$), the excitation of which is responsible for the appearance of the C_6H_6 spectrum. Comparison with the spectrum of solid PhCl at −259° supports the analysis. W. R. A.

Ultra-violet absorption spectra of amino-acids. A. D. Marenzi and F. Villalonga (*Rev. Soc. argent. Biol.*, 1941, **17**, 232—243).—23 NH_2-acids have been examined with a Zeiss spectrograph and a W arc. The aliphatic and the cyclic acids without a C_6H_5 ring show total absorption between 2600 and 2000 A.; those with C_6H_6 rings have selective absorption bands. It is not known where the absorption by aliphatic acids begins; position isomerides have the same absorption spectra. Substitution of H by OH or SH in the aliphatic acids shifts the absorption into the visible; this does not occur when OH is fixed on a pyrrolidine ring. NH_2-acids containing S show greater mol. extinction than other aliphatic acids; the characteristic curve of cystine is probably due to dissociation of the S·S group. Max. mol. extinction is produced by the cyclic NH_2-acids and it increases with increasing mol. wt. J. T. L.

Effects of hydrochloric acid and salts on the absorption of light by β-naphthaquinonesulphonic acid. B. Wingfield and S. F. Acree (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 361—370).—The spectral absorption of 3×10^{-4}M-β-naphthaquinonesulphonic acid has been measured in the presence of HCl, KCl, Li_2SO_4, $CaCl_2$, and $AlCl_3$. There is an increase in absorption with salt concn. but no marked shift in the absorption band; the increase in absorption $= k$(molal activity of electrolyte)$^{\frac{1}{2}}$, where k varies from 0·144 to 0·353. The results suggest that the sp. effects of ions on the absorption of indicators should be taken into account for accurate p_H measurements. D. F. R.

Effect of molecular environment on the absorption spectra of organic compounds in solution. II. αβ-Unsaturated ketones. K. L. Evans and A. E. Gillam (*J.C.S.*, 1941, 815—820).—The absorption spectra of a no. of αβ-unsaturated ketones in EtOH have been determined. In the majority of cases Woodward's generalisation (A., 1941, II, 197) that the nature of the substitution of the chromophoric group in these compounds can be predicted from the location of the main absorption bands holds satisfactorily. An exception is *iso*thujone. The effect on the absorption spectra of substituting simple αβ-unsaturated ketones with Me groups has been studied. Substitution on the β-C produces a larger bathochromic effect than does substitution on the α-C. Examination of the absorption spectra of some ketophenanthrene derivatives enables conclusions to be drawn concerning their structure if Woodward's generalisation is used. The generalisation does not extend to the location of the band due to the CO-group. A. J. M.

Light absorption of cobalt thiocyanate solutions. II. Aqueous non-electrolytes as solvents. A. von Kiss and P. Csokán (*Z. physikal. Chem.*, 1941, **A**, **188**, 27—40).—The extinction coeffs. of various solutions of $Co(CNS)_2$ in H_2O, org. liquids, and mixtures of H_2O and org. liquid have been measured at room temp. over the λ range 2000—7000 A. The changes in the form of the absorption curve produced by addition of org. liquid or of excess of CNS′ are attributed to the formation of complex mols. J. W. S.

Light absorption and constitution of chlorophyll derivatives. III. Absorption of the dihydroxy-compounds. F. Pruckner (*Z. physikal. Chem.*, 1941, **A**, **188**, 41—59).—The absorption spectra of dioxan solutions of the $(OH)_2$-compounds derived from various porphyrins are shifted towards lower $\lambda\lambda$ and towards higher $\lambda\lambda$ relative to spectra of the corresponding chlorins and porphyrins, respectively, but are most closely related to the spectra of the chlorins. The absorption spectra of HCl solutions of these compounds and of dioxan solutions of their Cu complexes also indicate their intermediate position between chlorins and porphyrins. J. W. S.

Method of spectrophotometry for solutions in liquified gases. Absorption spectra (in the visible region) of solutions of nitro- and azo-compounds in liquid ammonia [and liquid sulphur dioxide]. A. I. Schattenstein and E. A. Izrailevitsch (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 73—98).—Apparatus for the investigation of absorption spectra of solutions in liquified gases at −70° to 70° is described. Absorption spectra in the visible are recorded for solutions in aq. alkali, liquid NH_3, and liquid NH_3 containing KNH_2, of a large no. of indicators, and also of one indicator in liquid SO_2. The results confirm that the acid–base equilibrium in a solution depends on the nature of the solvent, and that SO_2 is an acid-like solvent. F. J. G.

Electron energy levels in biochemistry.—See A., 1942, III, 57.

Spectroscopic determination of association equilibria.—See A., 1942, I, 62.

Quenching of fluorescence in solution. III. Nature of the quenching process. G. K. Rollefson and R. W. Stoughton (*J. Amer. Chem. Soc.*, 1941, **63**, 1517—1520).—Measurements of the activity of a fluorescent substance in the presence of a quencher indicate that the quenching action cannot be attributed to complex formation before photoactivation. The effect of temp. and changes in η on the quenching process supports this idea. The simple resonance transfer theory and the electron transfer theory are discussed and shown to be inadequate. W. R. A.

Polarisation of fluorescence of simple aromatic hydrocarbons in solution. D. C. Chakravarti and S. C. Ganguly (*Trans. Faraday Soc.*, 1941, **37**, 562—566).—Analysis of the fluorescence of glycerol solutions of anthracene, phenanthrene, naphthacene, chrysene, and perylene, excited by polarised light of λ 3650, 4047, and 4358 A., shows that the polarisation is practically the same for all the fluorescence bands, and is independent of the frequency of the incident light. The results of measurements at 30° and −79° indicate that the polarisation in solutions of infinitely high viscosity, in which the mols. would be non-rotating but randomly oriented, must be ~50%. It is inferred that in the substances studied the mol. fluorescence is due either to a single linear oscillator or to a set of linear oscillators radiating independently. F. L. U.

Reversible photochemical processes in rigid media. Phosphorescent state. G. N. Lewis, D. Lipkin, and T. T. Magel (*J. Amer. Chem. Soc.*, 1941, **63**, 3005—3018).—The phosphorescence when a dye is illuminated in a homogeneous, rigid solvent has been examined theoretically and experimentally. With fluorescein in boric acid glass, a typical phosphor, two emission bands are found which are associated with two different unimol. processes (α and β) by which the phosphorescent state may return to the normal state. The

α-process obeys the Arrhenius equation and the heat of activation is 8±1 kg.-cal. The rate of the β-process has been investigated down to 20° K. The β-process cannot be unequivocably explained by suggested mechanisms. With intense illumination the phosphorescence approaches a max. and a new absorption spectrum, belonging to the phosphorescent state, appears. The dye mol. does not turn appreciably in the glass. A new kind of dichroism has been recognised from which the degree of orientation in the phosphorescent and normal states has been calc. W. R. A.

Raman effect in seventeen optical glasses. R. Norris (*Proc. Indian Acad. Sci.*, 1941, **14, A**, 178—186).—The Jena glasses examined all showed a continuum following the exciting line. The continuum is a genuine Raman effect, not due to fluorescence. Data are recorded for a no. of broad, diffuse bands in each glass examined. L. J. J.

Infra-red and Raman spectra of polyatomic molecules. XV. Diborane. F. Stitt (*J. Chem. Physics*, 1941, **9**, 780—786).—The infra-red spectrum of B_2H_6 from 400 to 4000 cm.$^{-1}$ shows much absorption, and further work will be required before a complete analysis can be made. On the assumption that B_2H_6 has the same structure as C_2H_6 two tentative analyses, both in accord with C_p data from 100° to 300° K., have been proposed. One of these requires a singlet electronic state 412 cm.$^{-1}$ above the ground state and a potential barrier within the mol. of ~15,000 g.-cal. per mol., whilst the other postulates an electronic state <1600 cm.$^{-1}$ above the ground state and a potential barrier of ~5000 g.-cal. per mol. W. R. A.

Raman spectra of acetylenes. V. Alkylacetylenes. M. J. Murray and F. F. Cleveland (*J. Amer. Chem. Soc.*, 1941, **63**, 1718—1721).—Raman displacements, estimated intensities, and depolarisation factors are given for 6 alkylacetylenes, but only νν and intensities for Δ^9-octadecinene. W. R. A.

Raman spectra of halogenated ethylenes. E. N. Prileshaeva, J. K. Sirkin, and M. V. Volkenstein (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 176—180).—The Raman spectrum of C_2Cl_4 in CCl_4 and C_6H_6 solutions is recorded, and compared with published data for other halogen derivatives of C_2H_4. A progressive decrease in the C:C frequency on halogenation is attributed to resonance with singly-bonded structures. F. J. G.

Raman effect. CXV. Rotation isomerism. VIII. Vinyl, acetyl, *iso*propenyl, and allyl derivatives. L. Kahovec and K. W. F. Kohlrausch (*Z. physikal. Chem.*, 1940, **B**, **46**, 165—180).—The Raman spectra of CH_2:CHI, AcI, and CH_2:CMeI, and additional measurements on CH_2:CMe_2, AcCl, AcBr, CH_2:CMeCl, and CH_2:CMeBr, are recorded. These data are compared with recorded data for other vinyl, Ac, *iso*propenyl, and allyl derivatives, and the spectra analysed. The results indicate the co-existence of at least two stereoisomerides in liquid allyl derivatives. F. J. G.

Raman effect. CXVI. New crystal powder apparatus. A. W. Reitz (*Z. physikal. Chem.*, 1940, **B**, **46**, 181—193).—Apparatus (of which the principle has been noted: A., 1937, I, 345) for determining Raman spectra of solid substances is described in detail. Results for *p*-OH·C_6H_4·CHO, pyramidone, antipyrine, C_6Cl_6, and C_6Me_6 are recorded and discussed. F. J. G.

Raman spectra evidence for hindrance of resonance by *o*-substitution. R. H. Saunders, M. J. Murray, and F. F. Cleveland (*J. Amer. Chem. Soc.*, 1941, **63**, 3121—3123).—Raman shifts for the CO in RCOMe, RCHO, RCOCl, RCO_2Me, and RNO_2 are determined for R = Ph, CH_2Ph, *o*-tolyl (except *o*-C_6H_4Me·COMe), and mesityl, and for duryl Me ketone. Comparison of the series Ph and CH_2Ph shows that conjugation of the CO and Ph causes the frequency to decrease by 20—30 cm.$^{-1}$ This indicates a decrease in the amounts of resonating quinonoid forms present, due to coplanarity of the Ph nucleus and the COX. *o*-Me lessens this decrease in the frequency, mesityl more so than *o*-tolyl; this is due to steric hindrance preventing coplanarity and thus stabilising the resonating quinonoid forms. However, the smaller CHO group is unaffected by steric hindrance and the decrease in frequency with mesitaldehyde is as great as with PhCHO. It is concluded that Raman spectra are of service in detecting steric hindrance. R. S. C.

Measurement of the radiation of hot flame gases with the photo-cell.—See A., 1942, I, 73.

Photo-electric cells for the visible spectral range.—See A., 1942, I, 74.

Relation between temperature radiation of white oxides and the photo-effect at sensitised metal surfaces. F. Skaupy (*Kolloid-Z.*, 1941, **94**, 65).—From the linear relationship between the temp. radiation of white oxides (Al_2O_3, ZrO_2) and temp. for specimens of different particle size it appears that the temp. corresponding with zero emission is the lower the smaller is the size. Further, the emission for a given temp. exhibits an upper limit of wave-length which increases with decrease of grain size. It is considered that the similarity between this behaviour and the photo-effect at metal surfaces indicates that the primary process in the latter effect is light absorption. F. L. U.

Conductivity and hardness of manganese-copper alloys.—See A., 1942, I, 53.

High-frequency energy losses in solutions containing macromolecules.—See A., 1942, I, 58.

Validity of the principle of superposition in solid dielectrics. H. Silva and B. Gross (*Physical Rev.*, 1941, [ii], **60**, 684—687).—A.c. measurements in carnauba wax in the frequency range 20—20 × 10^6 cycles per sec. are reported and results are correlated in terms of the principle of superposition. N. M. B.

Di*cyclo*pentadiene: preparation from the monomeride; dielectric constants of dimeride at several temperatures.—See A., 1942, II, 83.

Constancy of the valency angles of the carbon tetrahedron. Dipole moments of stereoisomeric βγ-dichloro-Δ^β-butenes. G. P. Michailov and D. V. Tischtschenko (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 129—138).—The dipole moments of the lower- and higher-boiling isomerides of βγ-dichloro-Δ^β-butene are 0·00 and 2·41 D., respectively, confirming that the latter is the *cis* isomeride. The val. 2·41 D. is in agreement with that calc. on the assumption that there is no deformation of the valency angle. Recorded data are compared to show that in aromatic and ethylenic derivatives the higher-boiling isomeride has the greater dipole moment. F. J. G.

Dispersion of silicate glasses as a function of composition. M. L. Huggins (*J. Opt. Soc. Amer.*, 1940, **30**, 514—518).—The dispersion of silicate glasses in the visible range can be calc. from their compositions and d by the use of a small no. of consts. characteristic of each element. In cases where the best data are available the average discrepancy between experimental and calc. vals. of $n_F - n_C$ is ~5—8 × 10^{-5}. A. J. M.

Brewsterian angle and refractive indices. A. H. Pfund (*J. Opt. Soc. Amer.*, 1941, **31**, 679—682).—A method of determination of refractive index (n) by measurements of the Brewsterian angle is described. Reliable n vals. can be determined for black materials such as anthracite coal and amorphous Se. Surface films must be eliminated to obtain reliable results. L. J. J.

Partition functions of molecules with internal torsions. I. Single asymmetric top attached to rigid framework. (Miss) D. Price (*J. Chem. Physics*, 1941, **9**, 807—815).—Mathematical. An extension of the method used by Crawford for "pseudo-rigid" mols. (A., 1941, I, 198) to the case involving mols. containing an asymmetric top. From the exact classical kinetic energy for a rigid framework with asymmetric tops a quantum-mechanical operator is derived for the case of one top with small moment of inertia and small asymmetry. From this operator the energy matrix of the mol. is obtained, and hence the partition function for translation and over-all and internal rotations, correct to second order. W. R. A.

Deduction of the concept "liquid with fixed structure" from a consideration of the expansion of thermodynamic functions of state for normal and highly-polymerised liquids. K. Ueberreiter (*Z. physikal. Chem.*, 1940, **B**, **46**, 157—164).—The entropy of a monomeric liquid may be written $S = S_V + S_T + S_{PO}$, where S_V refers to intramol. vibrations, S_T to thermal agitation, and S_{PO} to position and orientation of the mols. S_{PO} possesses a relaxation time, and if this becomes large the liquid is "congealed." The finite vals. of S at 0° K. for supercooled liquids are S_{PO}. For a highly polymerised liquid S_{PO} and S_T may each be subdivided into two terms, referring to the individual chain-members and to the chain as a whole. If the degree of polymerisation is sufficiently

great, the last terms may be neglected, so that $S = S_V + (S_T)_{micro} + (S_{PO})_{micro}$. The polymeride may thus be regarded as analogous to the monomeric liquid, but with the degree of mobility of the mols. arbitrarily limited: "liquid with fixed structure," and the fact that it congeals at higher temp., follow. Since the end members of a chain have greater mobility than those in the middle, increase of chain-length leads to decrease of total mobility and rise of temp. of congelation, but this tends towards a limit. The change of expansion coeff. on congelation is also due to the fixation of magnitudes dependent on orientation and position.
F. J. G.

Diamagnetic susceptibility of methane. C. A. Coulson (*Proc. Physical Soc.*, 1942, **54**, 51—54).—Mathematical. Calculations based on the mol.-orbital and electron-pair approx. wave functions are compared with the self-consistent-field val. (cf. Buckingham, A., 1941, I, 400), and show that in the latter an error of ~25% is due to the preliminary averaging of the positive charges on the four protons. The new vals. agree among themselves, but are ≫ the experimental val.; reasons are discussed. N. M. B.

Magnetic moments at high frequencies. L. Page (*Physical Rev.*, 1941, [ii], **60**, 675—684).—Mathematical. The magnetic moments of conducting permeable spheres and cylinders in an oscillating magnetic field are calc. as functions of the conductivity, permeability, radius of cross-section, and λ. The electric moment of a conducting sphere in an oscillating electric field is also obtained. Results are applied to the determination of the effect of particle size on the effective permeability of magnetic powders. N. M. B.

Electrostatic component of the force of sliding friction. R. Schnurmann and E. Warlow-Davies (*Proc. Physical Soc.*, 1942, **54**, 14—27; cf. A., 1941, I, 367, 370).—An experimental study of jerky motion due to relaxation oscillation. It is suggested that, owing to contact electrification, the electrostatic component of the force of sliding friction assumes appreciable proportions when the boundary layer has dielectric properties; thus cycles of slow charging and rapid discharging occur, and cause relative motion to proceed by cycles of slow sliding and rapid slipping when the average velocity, determined by the rate of propulsion of one friction element, is < the velocity for which the frictional force is a min. N. M. B.

Laws of deformation of real materials. II. Deformation of highly polymerised materials. V. A. Kargin and G. L. Slonimski (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 931—945).—The basic principles of Boltzmann and Volterra's theory of deformation have been applied to the physical changes which occur during deformation of highly polymerised materials. (Cf. A., 1942, I, 90.) C. R. H.

Calculation of the binding energy by the method of orthogonalisation. M. F. Mamotenko (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 946—947).—The exchange integrals and the binding energy of two like atoms with only one electron apiece outside the completed shells can be calc. from the integrals of non-orthogonalisation and the Coulomb integrals. The calc. binding energies of H_2 and Li_2 are 72 and 27 kg.-cal. per mol., respectively. C. R. H.

Surface tension and molecular dimensions. A. E. Ridler and J. H. Smith (*Nature*, 1941, **148**, 566—567).—Equations are presented showing that mols. of long-chain compounds tend to stand erect in their own liquid surfaces just as they do on substrates such as H_2O. ρ is independent of chainwise association in the surface layer. Data for MeOH, EtOH, Pr^{n}OH, Bu^{n}OH, *n*-octyl and myricyl alcohols are given; $d\gamma/dT$ is approx. the same for each alcohol, indicating that the mol. basal area is approx. equal for all the members of the series. L. S. T.

Whirling arm for producing small differences of pressure, its calibration by aid of a smoke manometer, and its application to measurements of surface tension.—See A., 1942, I, 75.

III.—CRYSTAL STRUCTURE.

High-intensity *X*-ray monochromator.—See A., 1942, I, 74.

Quantum theory of *X*-ray reflexion. (*a*) Basic ideas. (*b*) Mathematical formulation. (Sir) C. V. Raman. (*c*) **Experimental confirmation.** (Sir) C. V. Raman and P. Nilakantan (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 317—331, 332—355, 356—376).—A detailed account of work already noted (A., 1941, I, 402). W. R. A.

Quantum-theoretical explanation of the appearance of forbidden *X*-ray reflexions in diamond. P. R. Pisharoty (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 377—386).—Structure amplitudes of the dynamic stratifications excited in the crystal lattice of diamond when monochromatic *X*-radiation passes through a thin crystal have been calc. on the assumption that the incident *X*-rays impart to each degree of freedom corresponding with an infra-red oscillation of the lattice an energy of $h\nu^*$, where ν^* is the frequency of oscillation. Some planes which have zero structure amplitude for the classical Bragg reflexions have finite dynamic structure amplitudes for the Raman or quantum reflexions. This accounts for the appearance of the so-called "forbidden" reflexions in diamond. W. R. A.

Absolute intensity of the Raman *X*-ray reflexions in diamond. P. R. Pisharoty (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 434—438).—Lattice planes of diamond which are "allowed" and "forbidden" for the Raman reflexions by the lattice oscillation of 1332 cm.$^{-1}$ have been worked out. The intensities of the quantum reflexions from the (111) planes and of the incident monochromatised *X*-radiation at various settings are compared. W. R. A.

Multiple spots and streamers exhibited by the (111) dynamic reflexions in diamond. P. R. Pisharoty and R. V. Subrahmanian (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 439—444).—The three sets of phase waves of the lattice oscillations in diamond give rise to three Raman reflexions from the (111) planes, two of which appear as streamers if the angle of incidence, θ, < the Bragg angle θ_B and as spots when $\theta > \theta_B$. The intensity and orientation of these reflexions when the plane of incidence of the classical reflexion is parallel or inclined to a (110) symmetry plane are discussed. All oscillations of phase wave-lengths of ≮1000 lattice spacings are coherent, whilst those with $\lambda\lambda$ ~100 lattice spacings are incoherent. W. R. A.

Quantum reflexion and the quantum scattering of *X*-rays in rock-salt. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 395—401).—The diffuse max. in the Laue patterns of rock-salt are due mainly to quantum or Raman reflexions of the *X*-rays which excite monochromatic or infra-red vibrations in the crystal lattice. W. R. A.

Lattice spectrum and the Raman *X*-ray reflexions by rock-salt. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 426—433).—Lattice vibrations of rock-salt and the intensities of the first and second orders of the Raman *X*-ray reflexions from the (111), (100), and (110) planes have been calc. for the three principal modes of vibration. The intensities of the (222), (200), and (220) Raman reflexions are ∝ those of their corresponding Bragg reflexions. The intensity of the (111) Raman reflexion is only 1/40 of that due to (222), whereas the ratio of the corresponding Bragg reflexions is 9/33. W. R. A.

***X*-Ray reflexions of the second kind in metallic crystals.** B. Dayal (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 421—425).—The strong Raman reflexions from various lattice planes of Al are reported and discussed. The angle between the crystallographic planes and the phase waves is ~90°. W. R. A.

Quantum reflexion of *X*-rays in calcite. P. Nilakantan and P. G. N. Nayar (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 450—458).—Numerous planes in calcite exhibit quantum reflexions and the dynamic spacings do not vary much with the setting of the crystal. The sharpness of the reflexions, their intensities, and the influence of temp. have been investigated and interpreted by the quantum theory of *X*-ray reflexion. W. R. A.

Low-temperature studies of the Raman *X*-ray reflexions in crystals. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 387—394).—Raman reflexions of *X*-rays by carborundum (**I**), NaCl, $NaNO_3$, and pentaerythritol (**II**) have been determined at liquid air temp. and their intensities are compared with those at room temp. From the relative intensities at various temp. the infra-red ν active in the particular reflexion has been ascertained and is ~800 cm.$^{-1}$ for (**I**), 160 for NaCl, 200 for $NaNO_3$, and <100 for (**II**), in agreement with a low frequency observed in the Raman or

infra-red spectrum of the crystal. This *X*-ray effect, therefore, provides a means of evaluating infra-red $\nu\nu$ of crystals. W. R. A.

Raman *X*-ray reflexions in organic crystals. I. Naphthalene. II. Benzophenone. III. Hexamethylenetetramine. C. S. Venkateswaran. **IV. Benzil.** R. V. Subrahmanian (*Proc. Indian Acad. Sci.*, 1941, **14, A**, 402—408, 409—414, 415—420, 445—449).—I. Raman reflexions from 001, 01$\bar{1}$, 110, 11$\bar{1}$, 20$\bar{1}$, 200, 20$\bar{2}$, 120, 2$\bar{1}\bar{1}$, 22$\bar{2}$, and 2$\bar{2}\bar{2}$ planes of a crystal of $C_{10}H_8$ have been measured and the results are explained in relation to the crystal structure and lattice vibrations of $C_{10}H_8$ by the quantum theory of *X*-ray reflexion in crystals (see above).

II. Similar measurements on $COPh_2$ are recorded.

III. Reflexions from the (110), ($\bar{2}$00), (211), and (111) planes of $(CH_2)_6N_4$ have been measured and are discussed.

IV. The three alternate planes of the form (22$\bar{0}$1) in benzil give intense Raman reflexions when *X*-radiation falls along the trigonal axis or transverse to it. The three benzil mols. in the unit cell lie in equiv. positions along the three-fold screw axis with an inclination of 14° of the aromatic planes. This deduced inclination agrees well with the val. deduced from diamagnetic susceptibilities of the crystal. W. R. A.

X-Ray study of ternary solid solutions of magnesium and silicon in aluminium. X-Ray study of ageing of aluminium–magnesium–silicon alloys.—See A., 1942, I, 53.

Crystal structure of the carbamide–hydrogen peroxide additive compound, $CO(NH_2)_2,H_2O_2$. C. S. Lu, E. W. Hughes, and P. A. Giguère (*J. Amer. Chem. Soc.*, 1941, **63**, 1507—1513).—The space-group is D_{2h}^{14}—*Pnca* and there are 4 mols. per unit cell of a_0 6·86, b_0 4·83, c_0 12·92 A. The $CO(NH_2)_2$ mols. retain their configuration and H_2O_2 mols. have the configuration proposed by Penney and Sutherland (A., 1934, 1158) with the two OH linkings in planes making a dihedral angle of ~106°. The O—O distance is 1·46±0·03 A. and the packing of mols. is effected by H bonds. W. R. A.

Crystal structure of melamine. E. W. Hughes (*J. Amer. Chem. Soc.*, 1941, **63**, 1737—1752).—Melamine (I) has a monoclinic unit with *a* 10·54, *b* 7·45, *c* 7·25 A., β 112° 2′, space-group $P2_1/a$, 4 mols. per cell. Locations of atoms have been worked out and suggest resonance hybrid mols., the packing of which is effected by H bonds. The empirical resonance energies of (I) and other cyanuric derivatives have been calc. and compared with those calc. by quantum mechanics. The hemihydrated monohydrochloride of (I) is orthorhombic with *a* 16·75, *b* 12·29, *c* 6·93 A., space-group *Cmcm*, *Cmc*, or *C2cm*. W. R. A.

Electron diffraction observations of the surface reaction of hydrogen selenide on zinc oxide.—See A., 1942, I, 70.

Limits of the Kossel–Stranski theory of crystal growth. W. Kleber (*Kolloid-Z.*, 1941, **94**, 39—42).—Criticism of a paper by Balarev (*Kolloid-Beih.*, 1940, **52**, 45). F. L. U.

Anisotropy of the electronic work function of metals. R. Smoluchowski (*Physical Rev.*, 1941, [ii], **60**, 661—674).—Mathematical. Available explanations of the experimentally determined difference of the work function for different faces of a crystal are shown to be unsatisfactory. The Wigner–Bardeen theory is developed (cf. A., 1935, 1050). According to this theory the work function is a sum of a vol. contribution and one due to a double layer on the surface of the metal. The origin of the latter is described and general formulæ for the double layers are derived and discussed more fully for a simple cubic and a body-centred cubic lattice. The min. problem of the surface energy is solved for four faces of a body-centred crystal and results are applied to the case of W. The differences of work function of the respective faces are in satisfactory agreement with experiment. Calc. surface energies agree with the observed stability of certain crystal faces. N. M. B.

Magnetisation of single crystals of iron and of iron–nickel alloys in very weak fields. Y. Shimizu (*J. Inst. Metals Japan*, 1941, **5**, 175—188; *Japan Nickel Rev.*, 1941, **9**, 211—219).—The initial magnetic susceptibilities of single Fe crystals as determined by the method of demagnetisation by heating are 3—4 times the vals. obtained by demagnetisation by alternating fields. The difference, which is attributed to the agitating effect of magnetostriction due to the alternate fields, differs with the orientation of the crystal and decreases with rise of temp., vanishing at the crit. temp. For Fe–Ni alloys (18·5% Fe), of zero magnetostriction, the initial susceptibility is almost independent of temp. and alternating fields have no effect on it. J. W. S.

Mechanical properties of solids. E. N. da C. Andrade (*Nature*, 1941, **148**, 520—525).—A lecture. L. S. T.

ΔE effect of iron, nickel, and cobalt. M. Yamamoto (*J. Inst. Metals Japan*, 1941, **5**, 167—174; *Japan Nickel Rev.*, 1941, **9**, 206—210; cf. B., 1938, 1425).—The change of Young's modulus with magnetisation (ΔE effect) of annealed specimens of electrolytic Fe, Ni, and Co and of decarburised 0·1% C steel has been measured at 0—900 oersteds. The modulus is increased in each case to a saturation val. but Fe and Ni show a secondary increase in the field range below saturation, whilst the modulus of Co shows a max. and a min. in the low magnetisation range. The results for the steel are in accord with the view that the effect decreases with increasing C content, whilst the results for both Fe and Ni are in accord with current theories. J. W. S.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Electric and magnetic dimensions. G. D. Yarnold (*Proc. Physical Soc.*, 1942, **54**, 46—50; cf. Brown, A., 1941, I, 318; Duncanson, *ibid.*).—The distinction between the consts. having dimensions in the equation for an inverse-square law of force and the dimensionless consts. dielectric const. K and magnetic permeability μ is discussed. From the definitions given for K and μ the usual equations for the inverse-square laws of force are readily derived. N. M. B.

Magnetic behaviour of catalase.—See A., 1942, III, 171.

Dispersion by supersonics.—See A., 1942, I, 56.

Homologous series of α-substituted aliphatic acids.—See A., 1942, II, 74.

Heat content of silica, wollastonite, and thorium dioxide above 25°.—See A., 1942, I, 116.

Freezings and compressions to 50,000 kg. per sq. cm. P. W. Bridgman (*J. Chem. Physics*, 1941, **9**, 794—797).—The variation in melting temp. with pressure up to 50,000 kg. per sq. cm., the change in vol. on freezing, in terms of the vol. of the liquid at atm. pressure and room temp. as a function of pressure on the melting curve, and the latent heat of melting against pressure along the melting curve have been investigated for H_2O, Bu^{a}OH, EtOH, CH_2Cl_2, PhCl, $CHCl_3$, CS_2, Pr^{a}Br, and EtBr. In lower pressure ranges the entropy difference between liquid and solid decreases, but for five of the nine substances studied it increases along the curve. In this pressure range, also, subcooling of the liquid occurs and great sluggishness of growth of crystals, some substances not crystallising at all. No cases of superheating, *i.e.*, retarded liquefaction, were encountered. Compressibility of the solid phase is always < that of the liquid at the same pressure, but by >25%. Differences between the vols. of solid and liquid diminish with rising temp., as do abs. vols., but the internal energies appear to increase. W. R. A.

Latent heats of vaporisation. H. P. Meissner (*Ind. Eng. Chem.*, 1941, **33**, 1440—1443).—Theoretical. The Clapeyron equation can be rewritten as $\mathrm{d}\log_e p_0/\mathrm{d}(1/T_0) = -\Delta H/R(\mu_g - \mu_L)$ from which ΔH can be evaluated solely from data for v.p. and crit. temp. and pressure. Assuming that v.p. data for pure substances conform rigidly to $\log_e p_0 = -A/T_0 + B$, the former equation can be integrated to give $\ln p_{r_0} = [\Delta H/RT_c(\mu_g - \mu_L)][1 - /T_{r_0}]$. A graphical solution of this equation is presented enabling vals. of $\Delta H/T_c$ to be obtained with max. and average errors of ±9% and ±5%, respectively. (T_c = crit. temp., T_0 = saturation temp. at pressure p_0, $T_{r_0} = T_0/T_c$, p_{r_0} = reduced v.p., ΔH = mol. heat of vaporisation, $\mu_g = p_0 v_g/RT_0$, and $\mu_L = p_0 v_L/RT_0$, where v_g and v_L are mol. vol. of saturated vapour and liquid respectively. A and B are consts.) C. R. H.

Thermal properties of crystalline and glassy boron trioxide. J. C. Southard (*J. Amer. Chem. Soc.*, 1941, **63**, 3147—3150).—The vals. of H for temp. >298° K. have been determined for cryst. B_2O_3 (up to m.p.) and for glassy B_2O_3 (to 1777° K.). The heat and free energy of the reaction B_2O_3 (cryst.) → B_2O_3 (glass) are, respectively, 4360±20 and 2600 g.-cal. per g. formula wt. at 298·1° K. The calc. entropy of B_2O_3 glass

at 298·1° K. is 18·9±0·3 g.-cal. per degree per g. formula wt. An equation has been derived for the free energy of formation of liquid B_2O_3 at >1000° K. (Cf. A., 1942, I, 116.)
W. R. A.

Thermal expansion studies of borio oxide glass and of crystalline boric oxide. J. J. Donoghue and D. Hubbard (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 371—379).—Interferometric measurements of the expansion of cryst. B_2O_3 and B_2O_3 glass gave only qual. results, owing to the presence of H_2O. The sample of cryst. B_2O_3 melted at 450—451° and did not recrystallise on cooling. D. F. R.

Maximum difference between densities of ordinary and heavy water. T. L. Chang and J. Y. Chien (*J. Amer. Chem. Soc.*, 1941, **63**, 1709—1711).—From measurements of ρ of D_2O from its f.p. to 50° it has been shown that the max. difference between ρ_{D_2O} and ρ_{H_2O} is at 40°. W. R. A.

Melting curves of the gases A. Kr, Xe, CH_4, CH_3D, CD_4, C_2H_4, C_2H_6, COS, and PH_3, up to 200 atm. pressure. Volume change on melting. K. Clusius and K. Weigand (*Z. physikal. Chem.*, 1940, **B**, **46**, 1—37).—The initial slopes of the m.p.–pressure curves have been determined for A, Kr, Xe, CH_4, CH_3D, CD_4, C_2H_4, C_2H_6, COS, and PH_3. From the results the vol. differences between the solid and liquid phases have been calc. The relative vol. change on melting is approx. the same for the three inert gases, viz., ~1·15, and for H_2, HD, and D_2 ~1·12. From a consideration of the free mobility of the mols. in a liquid it is deduced that for an ideal monat. liquid in the neighbourhood of its f.p. the ratio of the mol. vols. of liquid and solid would be 1·14, in agreement with the val. found for the inert gases. The effects of departures from spherical symmetry, of association, and of excitation of new degrees of freedom on the vol. ratio are considered. It is to be expected, and is found, that the entropy of melting is symbatic with the vol. ratio. F. J. G.

Preparation and vapour pressures of *cyclo*butene and *cyclo*butane.—See A., 1942, II, 83.

Experimental verification of Thomson's equation. K. S. Lialikov (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 43—58).—The evaporation of a system of Hg drops has been studied statistically, and results in agreement with Thomson's equation are obtained for the range of radii 0·5—2·0 μ. F. J. G.

Complexity of phosphorus pentoxide. III. Appearance of two liquid phases. A. Smits [with E. P. S. Parvé, P. G. Meerman, and H. C. J. de Decker] (*Z. physikal. Chem.*, 1940, **B**, **46**, 43—61).—When quickly heated in a sealed capillary, the metastable volatile modification (I) of P_2O_5 melts at ~430° to a colourless liquid which very rapidly changes into the stable form. Apparatus is described by means of which the v.p. of a short-lived liquid may be determined in <10 sec., and with this the v.p. curve of liquid (I) has been determined from 452° to 488°. The triple point of (I) is at 423° and 3800 mm., its heat of fusion is 3·6 kg.-cal., and the heat of vaporisation of liquid (I) is 17·5 kg.-cal. per g.-mol. of P_4O_{10}. The two modifications are complex, and the relation between them is discussed in the light of this concept.
F. J. G.

Determination of Beattie–Bridgeman constants from critical data. F. W. Brown (*Ind. Eng. Chem.*, 1941, **33**, 1536—1537).—The equations of Maron and Turnbull (cf. A., 1941, I, 200) for the determination of Beattie–Bridgeman consts. have been derived in a simple manner from the law of corresponding states. The consts. for H_2 have been recalc. on the basis of the Lennard-Jones model of intermol. forces.
C. R. H.

Influence of constitution on the viscosity of liquids. R. Linke (*Z. physikal. Chem.*, 1941, **A**, **188**, 11—16).—The vals. of the consts. A and B in the Andrade–Sheppard equation $\log \eta = A + B/4{\cdot}57T$ are evaluated from the published vals. of η for various hydrocarbons. The effects of structural factors on the vals. of A and B in series of isomerides are deduced. J. W. S.

Structural viscosity of pectin sols.—See A., 1942, I, 58.

Viscosity nomographs for organic liquids. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 1537—1539).—Three nomographs have been constructed so as to permit solutions of Souders' η equation $\log(\log \eta) = Id/M - 2{\cdot}9$, where $I = \eta$-constitutional const., which may be evaluated by summation of general at. and structural consts., d = density, and M = mol. wt. C. R. H.

Laws of deformation of real materials. I. G. L. Slonimski (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 99—128).—Mathematical. A no. of deductions from the Boltzmann–Volterra theory are made for important special cases. (Cf. A., 1942, I, 85.) F. J. G.

Migration in crystal lattices. R. M. Barrer (*Trans. Faraday Soc.*, 1941, **37**, 590—599).—The treatment of diffusion in solids is developed by combining the kinetic method with the statistical theory of disorder in crystal lattices. Equations for the diffusion coeff. derived by assuming four different mechanisms lead to vals. of D which cover the observed range. In an alloy AB zeolitic diffusion of A is likely when the ratio of at. radii A : B is <0·59; when the radii are more nearly equal diffusion should occur usually by migration of Schottky defects or by place exchange. In salt pairs the mechanism is usually migration of Schottky or Frenkel defects. F. L. U.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Compressibility of gas mixtures. I. p–V–T data for binary and ternary mixtures of hydrogen, nitrogen, and carbon dioxide. I. R. Kritschevski and V. P. Markov (*Acta Physicochim. U.R.S.S.*, 1940, **16**, 59—66).—Data on the compressibility of binary and ternary mixtures of H_2, N_2, and CO_2 at 0—200° and at >500 atm. are recorded. F. J. G.

Equation of state for gas mixtures. J. S. Kasarnovski (*J. Phys. Chem. Russ.*, 1940, **14**, 1640—1652).—If all the pressures are given for the same mol. vol., the pressure of a mixture $p = p_1N_1 + p_2N_2 + aN_1N_2(p_1 - p_2)$, p_1 and N_1 being the pressure and mol. fraction of the first component, and a a const. In non-polar gas mixtures a is independent of temp.; in polar mixtures it depends on temp. but is independent of N_1. The equation can also be applied to mixtures of a gas and a saturated vapour, *e.g.*, to p of H_2 and NH_3 over liquid NH_3. An analogous equation is valid for ternary mixtures. J. J. B.

Regular solutions of gases in liquids. II. Concentrated solutions of hydrogen at high pressures. M. G. Gonikberg (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 921—930).—Equations for the equilibrium in gas–non-polar liquid systems at high concns. and pressures have been derived and tested with data for solutions of H_2 in liquid N_2, CO, CH_4, and C_2H_4. (Cf. A., 1941, I, 80.) C. R. H.

Densities of aqueous morpholine solutions. H. M. Trimble and (Miss) A. F. Buse (*J. Amer. Chem. Soc.*, 1941, **63**, 3236).—Vals. of ρ at 25°, 30°, and 35° have been determined pyknometrically for aq. morpholine (I) solutions [14·2—100 wt.-% of (I)]. For (I) $n^{20} = 1{\cdot}4542 \pm 0{\cdot}0002$. W. R. A.

Viscosities of binary liquid mixtures. R. Linke (*Z. physikal. Chem.*, 1941, **188**, 17—26).—The η of binary mixtures containing C_6H_6, PhMe, PhCl, and *cyclo*hexane have been measured at various temp. and the consts. A and B of the Andrade–Sheppard equation are evaluated. In most cases A and B vary linearly with the mol. composition of the mixture, but with mixtures containing *cyclo*hexane large deviations from linearity are observed, the effect being the greater the lower is the dipole moment of the second component. J. W. S.

Vapour pressures of binary liquid mixtures. J. R. Lacher and R. E. Hunt (*J. Amer. Chem. Soc.*, 1941, **63**, 1752—1756).—An apparatus for making vapour–liquid equilibrium measurements is described and its accuracy is discussed. The systems $C_2H_4Br_2$–PhCl and –Pr^nNO_2 have been investigated. Both show positive vol. changes on mixing (i) and the excess entropy change (ii) is of the same sign. The qual. correlation between (i) and (ii) is discussed with reference to these and other systems and an explanation is tentatively offered. W. R. A.

Theory of osmotic pressure. W. V. Metcalf (*Kolloid Z.*, 1941, **94**, 157—161).—The objections raised by Thiel (*ibid.*, 1940, **91**, 316) against the author's theory (A., 1940, **I**, 354) are discussed and considered to be invalid. F. L. U.

Determination of diffusion coefficients. B. Serin and R. T. Ellickson (*J. Chem. Physics*, 1941, **9**, 742—747).—Diffusion

equations derived from Fick's law are discussed and a graphic method to extend their applicability is developed. The law is shown to be in accord with experimental data for the diffusion of O_2 in Cu (A., 1940, I, 19), for which the activation energy is 50·5 kg.-cal. per g.-mol. The law is also in accord with literature data for the rates of interaction of SiO_2 and $BaCO_3$ at 800—890° and of $CaCO_3$ and MoO_3 at 487—550°. J. W. S.

Diffusion coefficients in solution. Improved method for calculating D as a function of concentration. W. G. Eversole, J. D. Peterson, and H. M. Kindsvater (*J. Physical Chem.*, 1941, **45**, 1398—1403).—A new equation expressing diffusion coeff. as a function of concn. corrects inaccuracies in an earlier derivation (cf. A., 1935, 702; 1937, I, 459). C. R. H.

Solutions. Relationship between surface tension, internal pressure, vapour pressure, and osmotic pressure. A. Giacalone (*Z. physikal. Chem.*, 1941, **A, 188**, 1—10; cf. A., 1940, I, 203; 1941, I, 80).—Substances which lower or raise the γ of H_2O also produce corresponding departures from the theoretical v.p. depression and properties associated with it. Thus aliphatic alcohols, acids, amides, and ketones decrease, and inorg. salts increase, the f.p. depression relative to the theoretical val. The effect of salts is the greater the higher is the valency of the cation, and is ascribed to electrostatic dipole interaction between the ions and H_2O mols. J. W. S.

Surface tension, liquid density, and vapour density of sulphur dioxide solutions of potassium thiocyanate at 10°, 15°, 20°, and 25°. W. G. Eversole, G. H. Wagner, and G. C. Bailey (*J. Physical Chem.*, 1941, **45**, 1388—1397).—Experimental vals. covering the range 0—0·8M-KCNS are recorded. The increase in relative surface tension (σ/σ_0) with molarity is much more pronounced than in aq. solutions. In the dil. range the large positive slope of the σ/σ_0–molarity curve agrees with the Onsager–Samaras theory. An apparatus for measuring v.d., d, and σ on the same solution in a closed system is described. C. R. H.

Solutions with anomalous viscosity. K. Boedeker (*Kolloid-Z.*, 1941, **94**, 161—163).—Polyglycol ethers of the composition $R{\cdot}C_6H_4{\cdot}(O{\cdot}CH_2{\cdot}CH_2)_n{\cdot}OH$ (R = alkyl) are insol. in H_2O when n is <6, beyond which the solubility increases with increasing n. Aq. solutions in which $n = 10$—12 become turbid when the temp. is raised and separate into two liquid phases, one being nearly pure H_2O, the other ether containing an amount of H_2O that decreases with rising temp. For a given concn. η first decreases slightly with rising temp. over a short range, and then increases rapidly, reaching a max. just before demixing occurs. At const. temp. η exhibits a max. at ~60 vol.-% of the ether; this max. may reach very high vals. (1370 at 20°, $H_2O = 1$) and the system may solidify at the room temp. These effects are attributed to a combination of solvation and immobilisation of solvent by the formation of a network. F. L. U.

Electric polarisation and association in solution. III. Dipole moments of alcohols in very dilute benzene solutions. A. A. Maryott (*J. Amer. Chem. Soc.*, 1941, **63**, 3079—3083). The polarisations and dipole moments (μ) of MeOH, EtOH, $Pr^{\beta}OH$, and $Bu^{\gamma}OH$ have been determined in C_6H_6 at 30°. Vals. of μ are: MeOH 1·62; EtOH, $Pr^{\beta}OH$, $Bu^{\gamma}OH$ 1·66. The concns. of alcohol were 10^{-4}—10^{-2} mol. fraction. No change of polarisation with concn. was observed. Since ascertained vals. are $<$ recorded vals. there is a slight negative solvent effect. W. R. A.

Magnitude of the solvent effect in dipole moment measurements. IV. Determination of distortion polarisation and its additivity in the alkyl and aryl halides. A. Audsley and F. R. Goss (*J.C.S.*, 1941, 864—873; cf. A., 1940, I, 354, 358).—Methods for determining the distribution of the polarisation of binary liquid mixtures between their components are discussed. By combining data for liquid and vapour states it is possible to determine the distortion potential, P_{E+A}, with accuracy. Within certain limits P_{E+A} can be treated as an additive property, so it is possible to determine it for the volatile members of an homologous series and thence, by adding definite increments, to calculate P_{E+A} for the higher non-volatile members. The vals. of P_{E+A} for C, H, and the halogens in compounds of the type RX are calc., and it is shown that whereas the electron polarisation P_E increases, P_A tends to decrease through the series F, Cl, Br, I. A. J. M.

Dispersion of the dielectric constants of solutions of strong electrolytes. M. V. Belikov and B. N. Finkelstein (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 303—308).—The effects of variations of the frictional and electrophoretic forces with frequency on the frequency-variation of the dielectric const. and hence on the conductivity of strong electrolytic solutions are deduced mathematically. J. W. S.

Incorporation and diffusion of foreign atoms in the zinc sulphide lattice. N. Riehl and H. Ortmann (*Z. physikal. Chem.*, 1941, **A, 188**, 109—126).—The diffusion of foreign atoms (Cu, Ag, Mn, Fe) in ZnS phosphors has been studied. The initial temp. and velocity of diffusion are independent of the anion with which the diffusing atom is originally combined, and of the presence or absence of a flux. The initial temp. for diffusion are: Cu, ~300°; Ag, ~400°. ZnS–Cu phosphors can be prepared in the ordinary way at 450°, ZnS–Ag phosphors at $\not<$580°, and the former are always the more coarsely cryst. These results indicate that the diffusion occurs through the vacant lattice spaces, and more easily with Cu on account of its smaller size, and also that the presence of the foreign atom hinders recrystallisation, again less so in the case of the smaller Cu atom. When present together, Cu and Ag atoms diffuse simultaneously, but the diffusion of the latter soon ceases, Ag can diffuse into a ZnS–Cu phosphor containing 0·01% of Cu, but not into one containing 0·2%. No displacement of Cu by Ag occurs. On the other hand Cu diffuses readily into ZnS–Ag phosphors, displacing Ag, which wanders to the surface of the crystal and may be chemically detected there. The phosphorescence of ZnS–Cu and ZnS–Ag phosphors is " killed " by heating at 950°, but not at 600°, with FeS. On the other hand Fe can be chemically detected in the phosphors after heating at 270°. This indicates that at the lower temp. Fe diffuses into vacant spaces, but at the higher temp. displaces Cu or Ag atoms. The diffusion of Mn is slow at 800°, rapid at 950°, indicating that it occurs not in vacant spaces but by displacement of Zn, and, correspondingly, the diffusion of Mn is not hindered by the presence of Ag and causes no displacement of Ag from ZnS–Ag phosphors. When cryst. ZnS is heated with FeS and MnS at 800°, the blue luminescence of the ZnS is at first " killed " by the Fe, but on continued heating the luminescence of Mn appears, confirming that the Mn displaces Zn and does not occupy vacant spaces. F. J. G.

Thermodynamic properties of binary solid solutions on the basis of the nearest neighbour approximation. E. N. Lassettre and J. P. Howe (*J. Chem. Physics*, 1941, **9**, 747—754).—Mathematical. A method for calculating the approx. partition function for a binary solid solution is developed on the assumption that the mols. of the two components are distributed at the lattice points of a given lattice and that the energy of a configuration is determined by the interaction of nearest neighbours. J. W. S.

Thermodynamic properties of binary solid solutions. Phase separation. E. N. Lassettre and J. P. Howe (*J. Chem. Physics*, 1941, **9**, 801—806).—Mathematical. By an extension of a method previously developed (cf. preceding abstract) it is shown that for a lattice which is large in at least two dimensions the largest eigenval. of the fundamental matrix is doubly degenerate over a finite temp. range, and in this range a separation into phases occurs. W. R. A.

Refraction and dispersion of glasses. J. C. Young and A. N. Finn (*J. Opt. Soc. Amer.*, 1941, **31**, 383—384).—The results of Huggins (A., 1941, I, 163, 408) are in agreement with those of the authors (B., 1941, I, 226). L. J. J.

Anomalous changes in the α phase of the nickel–antimony system. N. Shibata (*J. Inst. Metals Japan*, 1941, **5**, 41—45; *Japan Nickel Rev.*, 1941, **9**, 226—227).—Thermo-magnetic, dilatometric, and electrical resistance measurements confirm that the anomalous changes in the α phase of the Ni–Sb system are due to the formation of an ordered α' phase. It is formed at ~460° and its range of existence at room temp. is ~88—90% of Ni. It is paramagnetic, so the Curie point of Ni is lowered by adding Sb and vanishes suddenly over the composition range 88—90% Ni. J. W. S.

Longitudinal magneto-resistance effect at various temperatures in nickel–cobalt alloys. Y. Shirakawa (*J. Inst. Metals Japan*, 1941, **5**, 35—41; *Japan Nickel Rev.*, 1941, **9**, 229—231).—The resistance of various Ni–Co alloys has been

measured at −195° to 1150° and in longitudinal magnetic fields of 0—1600 oersteds. The changes in the resistance of the face-centred cubic and hexagonal close-packed solid solutions are similar to the changes observed with pure Ni and Co, respectively. The change is high for the face-centred cubic alloys, particularly at low temp. J. W. S.

New type of *A*3 transformation of iron–nickel alloy due to supercooling and the mechanism of the formation of an intermediate phase during the quenching of the eutectoid alloy. K. Iwase and S. Takeuchi (*J. Inst. Metals Japan*, 1941, **5**, 68—76; *Japan Nickel Rev.*, 1941, **9**, 205—206).—The *A*3 transformation of Fe–Ni alloy in which α phase containing less Ni than austenite is pptd. from the austenite proceeds so slowly that it can easily be stopped and the austenite supercooled. If the austenite is kept at a temp. at which α and γ phases can coexist it remains supercooled, but if kept in the temp. range of the homogeneous α phase the $\gamma \rightarrow \alpha$ lattice change occurs with change of *d*. Hence with alloys of low [Ni] the α phase is formed regardless of the speed of quenching, but with high [Ni] austenite persists at room temp. even after slow cooling. This, however, changes to the α phase on cooling below room temp. When slight pptn. occurs during cooling, however, the residual austenite becomes richer in Ni and the lattice transformation point is lowered, leading in some cases to the persistence of " remnant austenite " at room temp. The intermediate phase sometimes occurring in eutectoid alloys is a supersaturated α-solid solution. J. W. S.

Equilibrium diagram of the complete ternary system copper–antimony–nickel. II. Equilibria in the solid state of the whole ternary alloy system. N. Shibata (*J. Inst. Metals Japan*, 1941, **5**, 12—25; *Japan Nickel Rev.*, 1941, **9**, 223—226).—The system has been studied by dilatometric and microscopic methods and the results are recorded in tables and graphs. J. W. S.

Magnetic investigation of ternary alloys of the copper–antimony–nickel system. N. Shibata (*J. Inst. Metals Japan*, 1941, **5**, 46—49; *Japan Nickel Rev.*, 1941, **9**, 227—228).—The magnetic crit. points of Ni–Cu alloys are higher than those recorded previously. The Curie point of Ni (380°) is lowered by the addition of Cu and with ~40% Cu is at room temp. The effect of Sb on the crit. point of Ni is ≫ that of Cu. Annealing decreases the magnetic field of the ternary alloys in the as-cast condition, this effect being greater for alloys in the composition range in which the susceptibility to dendrite formation is more pronounced. J. W. S.

Transformations and mass effect in nickel–chromium and nickel–chromium–molybdenum steels. H. Shimoda (*J. Iron and Steel Inst. Japan*, 1941, **27**, 1—8; *Japan Nickel Rev.*, 1941, **9**, 229).—By cooling at different rates in a Sato quenching test machine the change of transformation point with cooling rate and the velocity of transformation of open-hearth Ni–Cr and Ni–Cr–Mo steels have been determined. The effect of cooling rate on the mechanical properties of Charpy and tensile specimens tempered at various temp. has also been investigated. J. W. S.

***X*-Ray investigation of iron–nickel–chromium alloys.** A. J. Bradley and H. J. Goldschmidt (*Iron and Steel Inst.*, 1941, *Advance copy*, 11 pp.).—From *X*-ray powder photographs of slowly cooled Fe–Ni–Cr alloys the relative amounts of the different constituents present were determined and the phase boundaries delineated in a ternary diagram. The four single-phase fields correspond with α body-centred cubic Fe-rich solid solution, α′ body-centred cubic Cr-rich solid solution, γ face-centred Ni-rich solid solution, and σ-FeCr; the two-phase fields are α + γ, α′ + γ, α + σ, α′ + σ, and γ + σ and the three-phase fields α + γ + σ and α′ + γ + σ. The no. and structure of the phase fields confirm the results of earlier work but the boundaries are different, showing that many alloys are very susceptible to heat-treatment at low temp. The range of σ is considerably broadened by addition of Ni, for whilst it is practically confined to the theoretical composition FeCr in the binary system it extends to ~6% of Ni and from 45 to 60% of Cr in the ternary and the solubility limits vary greatly with change in temp.; it is suggested that a large part of the α′ may transform to σ on very prolonged low-temp. annealing. A. R. P.

Solubility of macromolecular substances.—See A., 1942, I, 97.

Entrainment of cobalt by stannic sulphide. J. F. Flagg (*J. Amer. Chem. Soc.*, 1941, **63**, 3150—3153).—The entrainment of radio-Co^{++} by SnS_2 has been investigated at different temp., p_H, time of keeping, and radio-Co^{++} concn. The entrainment decreases with rising temp. and with acidity and the log of amount entrained per g. $SnS_2 \propto$ the log of radio-Co^{++} concn. Addition of acraldehyde prevents entrainment. W. R. A.

Sorption of hydrogen by metals. Temperature variation experiments. C. W. Griffin (*J. Amer. Chem. Soc.*, 1941, **63**, 2957—2960; cf. A., 1939, I, 195).—The sorption of H_2 on Pt and Co in the massive state and supported on brick has been investigated over the temp. cycle −78·5° to 0° to −78·5° and the pressure range 0 to 760 mm. Adsorption and dissolution occur. The sorptive process is mainly adsorption on the supported metal, little dissolution taking place. In the massive state the dissolution is 5—10 times that in the supported condition. W. R. A.

Adsorption of electrolytes on charcoal. E. Kutschinski, R. Burstein, and A. Frumkin (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 795—830).—Over a wide range of electrode potentials (φ) there is a linear relation between φ of an activated C electrode in H_2SO_4, KOH, and Na_2SO_4 solutions and the amount of adsorbed electrolyte, except when φ approaches zero. The variations of the zero-point charge between φ = −0·05 and 0·15 are explained by the influence of adsorbed O on the mechanism of the origination of the interfacial potential. The magnitude of this variation ∝ the quantity of electricity necessary to displace φ by a definite amount. The relation between φ and the amount adsorbed by a C electrode oxidised at 400° has been investigated and shown to be explainable in terms of the electrochemical theory. C. R. H.

Adsorption at crystal–solution interfaces. XII. Adsorption of isomeric dyes by crystals of cupric acetate during their growth from solution. W. G. France and (Miss) K. M. Wolfe (*J. Amer. Chem. Soc.*, 1941, **63**, 1505—1507).—Dyes, prepared by coupling diazotised NH_2Ph (*A*) and *o*- (*O*), *m*- (*M*), and *p*- (*P*) -sulphonated NH_2Ph with mono- and di-sulphonic acids of α- and β-$C_{10}H_7$·OH and -$C_{10}H_7$·NH_2, were adsorbed by $Cu(OAc)_2$ crystals during their growth from solution. *M* and *P* dyes predominate in the formation of orthodome faces on $Cu(OAc)_2$, whilst *A* and *O* dyes predominate in the stair-step formation. Most of the adsorbed dyes possess PhN_2·$C_{10}H_7$-1 nucleus. Nine pairs of dyes with NH_2 replacing OH on the $C_{10}H_7$ ring have the same effect on the crystal habit of $Cu(OAc)_2$. The orthodome faces of $Cu(OAc)_2$ appear to have alternate layers of positive and negative ions and the C atoms of the OAc groups appear to lie along the two-fold axis of symmetry. The possibility of a layer lattice in $Cu(OAc)_2$ is also indicated by the b.p. and lack of hardness. W. R. A.

Effect of the solubility of silver salts on their adsorption by composite gels of silica and sesquioxides. V. A. Kargin, P. S. Vassiliev, and O. I. Dmitrenko (*J. Phys. Chem. Russ.*, 1940, **14**, 1628—1639).—The magnitude of adsorption of Ag$^+$ from salt mixtures by gels of Fe_2O_3, $Fe_2O_3 + 2SiO_2$, and $Al_2O_3 + SiO_2$ usually is large when a slightly sol. Ag salt can be formed. Thus, Na_2SO_4 raises the adsorption of Ag$^+$ from $AgNO_3$ more than NaOAc or $NaNO_3$ do, since Ag_2SO_4 is less sol. than AgOAc or $AgNO_3$. This effect can be masked by competition between Na$^+$ and Ag$^+$ for the adsorption space. From a solution of $AgSO_4$ alone Ag$^+$ is adsorbed more than from $AgNO_3$ alone, and the adsorption isotherm often rises at high concns. like those of nearly saturated vapours. J. J. B.

Electro-capillary curves in liquid ammonia. II. Inorganic electrolytes. A. M. Murtazaev (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 225—230; cf. A., 1939, I, 520).—A method for determining electro-capillary curves in liquid NH_3 at room temp. is described. From the electro-capillary curve of N-NH_4NO_3 in NH_3 in contact with Hg the capacity of the electric double layer on the Hg is calc. to be 11 μF. per sq. cm. Addition of NaCl, NaBr, and KI causes a shift of the electro-capillary curve similar to that shown in aq. solution. J. W. S.

Spreading of oils on water. II. Non-ionised molecules having only one polar group. W. A. Zisman (*J. Chem. Physics*, 1941, **9**, 729—741; cf. A., 1941, I, 411).—Alcohols, esters, ketones, phenols, and non-ionised acids and amines cause spreading of a mineral oil on H_2O only when their mol. concn.

in the oil is > a certain val., dependent on the nature of the polar group, the chain length, the possible geometrical configurations of the mol., and its solubility in the oil. Spreading is shown to be due to reversible adsorption at the oil–H_2O interface associated with the osmotic pressure of the polar mols. dissolved in the oil. The average life of the adsorbed mols. is ≪ that of ionisable mols. The area per mol. at film pressure 11·3 dynes per cm. has been calc. for a no. of compounds and its changes with the chain length and the nature of the polar group are discussed. The occurrence of anomalous spreading due to the formation of cryst. ppts. of the polar compounds has been used to measure the solubility in oils of various straight-chain saturated acids and alcohols. J. W. S.

Spreading of oils on water. III. Spreading pressures and the Gibbs adsorption relation. W. A. Zisman (*J. Chem. Physics*, 1941, **9**, 789—793).—When spreading pressure is plotted against concn. of long-chain alcohols the curves are hyperbolas. Empirical formulæ have been fitted to each alcohol and an equation of state of the polar mols. adsorbed at the oil–H_2O interface has been derived. The interfacial monolayer consists of a stable mixed film of polar and non-polar mols. Applications to the interpretation of phenomena involved in stabilisation of emulsions and the structure of cell membranes are noted. W. R. A.

Spreading coefficients of Nekal BX solutions. M. R. B. Rao and K. S. G. Doss (*Proc. Indian Acad. Sci.*, 1941, **14, A**, 170—177).—Langmuir's floating lens method has been used to determine the spreading coeff. of paraffin oil on aq. Nekal BX (I) solutions. Small (~0·005%) concns. of (I) increase the spreading of the oil on H_2O very markedly, whilst higher concns. produce little further effect. Spreading coeffs. of (I) solutions on oil surfaces become less negative with increasing concn. of (I), but remain negative up to 0·2%. It is concluded that wetting by such solutions takes place by penetration rather than by spreading. Adhesion tensions of aq. solutions against oil give a better measure of the wetting power. L. J. J.

Repulsive forces between surfaces divided by liquid films. B. Derjaguin (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 314—316).—An error in Langmuir's theory (A., 1939, I, 140) of the repulsive forces in wetting films of aq. electrolytes is pointed out. Correction of this error increases the discrepancies between the calc. and observed decrease of the γ of H_2O produced by small additions of electrolyte. It is inferred that Jones and Ray's experiments do not permit the calculation of the thicknesses of wetting films, which have been measured directly (A., 1938, I, 194). J. W. S.

Unstable interfacial solutions. H. Dunken (*Z. physikal. Chem.*, 1940, **B, 46**, 38—42).—The conditions for formation of an interfacial solution are discussed. It is shown experimentally that by addition of stearic acid (I) to a H_2O–C_6H_{14} interface an unstable interfacial solution is realised, (I) forming at first a unimol. layer in the interface before passing completely into the C_6H_{14}. F. J. G.

Viscosity and relaxation in unimolecular layers. A. E. Bresler and S. E. Bresler (*J. Phys. Chem. Russ.*, 1940, **14**, 1604—1619).—A paraffin wax dish carries in the middle a paraffin disc on a stem; when the dish is filled the H_2O level is 1 cm. above the disc. Into the H_2O is lowered a paraffin ring the radius of which is > that of the disc. The film is deposited on the surface bounded by the ring; it rotates when the dish and disc are rotated. The speed of paraffin particles embedded in the film depends on the distance from the centre of the ring; it increases with the no. of revolutions of the dish and the area per mol. of the film. The speed t sec. after the rotation of the dish has started is $v_0[1 - \exp.(-t/\tau)]$, v_0 = const., τ = relaxation time; this equation is analogous to those obtaining in gels. The val. of τ is, *e.g.*, 10·2 sec. for myristic acid at 32·6 A.² per mol., 12·6 sec. for cetyl alcohol at 30·7 A.², 11·0 sec. for Et stearate at 29·9 A.², and 12·1 sec. for Et 1 : 16-dimethyltetradecandicarboxylate. $CaCl_2$ and $Al(NO_3)_3$ do not affect the viscosity of the films when the solution is in contact with paraffin wax only. If a glass ring is used, $CaCl_2$ (10^{-3}M.) and $Al(NO_3)_3$ (10^{-4}M.) increase the τ of dil. myristic acid films by 50—100%. Conc. films on these salt solutions are rigid and move as a whole. Since films on salt solutions possess shear elasticity they cannot consist of perfectly oriented mols. Probably mols. in the monolayers are entangled; this picture accounts also for the area per mol. being higher in films (20·5 A.²) than in crystals (18 A.²). J. J. B.

Mechanical (elastico-viscous) properties of thin gliadin layers. Formation and collapse of their structure. A. S. Achmatov (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 253—268).—Using the methods described previously (A., 1939, I, 73) it has been shown that when a grain of gliadin is deposited on a clean surface of 0·1N-HCl a surface layer is gradually formed, the two-dimensional pressure and phase-boundary potential varying regularly with time but attaining const. vals. in 5—10 min. The phase-boundary potential isotherm is in satisfactory agreement with that obtained by Hughes and Rideal (A., 1932, 909). Studies of the logarithmic decrement of oscillations with time carried out by the oscillating disc method show a considerable increase in the decrement with increasing period, suggesting the existence of a structure in the films. The mechanical energy absorbed by the film was ~1·87 erg per period (14 sec.). Irradiation with ultraviolet light (λ < 2800 A.) causes irreversible collapse of the film followed by the production of sol. decomp. products. J. W. S.

Change of concentration in electrolyte solutions during filtration through collodion membranes. W. Hacker (*Kolloid-Z.*, 1941, **94**, 11—29).—Aq. solutions of HCl, LiCl, NaCl, KCl, RbCl, NH_4Cl, $MgCl_2$, and $BaCl_2$ were filtered through collodion membranes, and any changes in concn. were determined by measuring the conductivity of the liquid on the membrane and of the filtrate. No measurable change occurred with LiCl, $MgCl_2$, and $BaCl_2$; in the others the filtrate was less conc. than the original liquid, the concn. of which in all cases was ~0·001N. The sieve action always increases with increase in the rate of stirring of the liquid being filtered, and with HCl it increases also with dilution. F. L. U.

Shear-elasticity in the surface of suspensions and sols, particularly of fibrinogen solutions. W. Grüning (*Kolloid-Z.*, 1941, **94**, 164—169).—Surface elasticity is shown by suspensions of kaolin, talc, animal C, etc. in H_2O, and by sols of V_2O_5 and of benzopurpurin. Defibrinated blood (ox, pig, horse) normally shows the same effect, but, except with horses' blood, the effect is abolished when the blood is conc. by centrifuging and the removal of some plasma. The surface elasticity of fibrinogen solutions is destroyed by denaturation and by the addition of thrombin, trypsin, or albumin (albumin from some sources is ineffective), but is not notably affected by variation of p_H or of the concn. of NaCl. F. L. U.

Modified theory of the electrical double layer. R. B. Whitney and D. C. Grahame (*J. Chem. Physics*, 1941, **9**, 827—828).—A preliminary note presenting a picture of the double layer at a metal–solution interface. Adjacent to the metal there is a partly filled layer of specifically adsorbed negative ions, not separated from the surface by H_2O mols. A diffuse layer of positive and negative ions extends from the metal into the interior of the solution. Since a hydrated cation is usually larger than an unhydrated anion the anion approaches the metal more closely. W. R. A.

Determination of viscosity at high stresses and defined rates of shear. II. F. Wachholtz and W. K. Asbeck (*Kolloid-Z.*, 1941, **94**, 66—81).—Linseed oil containing 10 vol.-% of TiO_2 pigment exhibits anomalous flow even at the high rates of shear (s) obtained with the band viscometer previously described (*ibid.*, 1940, **93**, 280). The force–flow relations for this suspension are represented equally well by Bingham's and Ostwald's formulæ, but for a 45 vol.-% suspension in mineral oil only by Bingham's. In order to compare the viscous behaviour of different suspensions the val. of η at an infinitely high rate of shear must be calc. This may be done by plotting log η against $1/\sqrt{s}$, when the straight lines obtained can be extrapolated to cut the log η axis at $s = \infty$. The vals. of η_∞ obtained in this way can be used to characterise the suspensions. Thus, the shape of the curves log η_∞–vol.-% solid is independent of the η of the liquid used provided no chemical action occurs; it depends, however, on the shape of the suspended particles. There is a linear relation between log η_∞ of the suspension and log η_∞ of the oil; if chemical action occurs (*e.g.*, between Zn-white and α-crotonic acid present in the oil) the slope of the curves is altered, but they remain linear. The curves give no

information about the behaviour of the suspensions at low *s* vals. F. L. U.

Congo-rubin. R. Haller (*Kolloid-Z.*, 1941, **94**, 199—203).—When a 0·1% solution of Congo-rubin is filtered through a column of finely divided $CaCO_3$ at 70—80°, the greater part is adsorbed and forms a blue layer from which the dye can be extracted with boiling H_2O. The filtrate is a red solution which shows no colour change on the addition of electrolytes. Congo-rubin solutions therefore contain two disperse phases of different dispersities. F. L. U.

Constitution of dilute soap solutions.—See A., 1942, I, 99.

High mol. wt. aliphatic amines and their salts. I. Behaviour of the hydrochlorides of dodecylamine and octadecylamine in water. A. W. Ralston, E. J. Hoffman, C. W. Hoerr, and W. M. Selby (*J. Amer. Chem. Soc.*, 1941, **63**, 1598—1601).—The systems $C_{12}H_{25}\cdot NH_2$,HCl–H_2O and $C_{18}H_{37}\cdot NH_2$,HCl–H_2O have been investigated. Except when very dil., all solutions yield foams which are stable for several hr. Certain concn. ranges exhibit thixotropy and many samples have stringy, curd-like fibres. These and other properties indicate the colloidal properties in these systems. The phase rule diagrams resemble those obtained with compounds in which the aliphatic group is part of the anion. W. R. A.

Solubility of macromolecular substances. IX. Separation of multimolecular mixtures by fractional precipitation. G. V. Schulz (*Z. physikal. Chem.*, 1940, **B**, **46**, 137—156).—Theoretical. It is shown that in the partition of a mixture of polymerides between two immiscible liquids, the higher polymerides are conc. preferentially in the liquid in which the potential energy is lower, and the more so, the smaller is the relative vol. of this liquid. The influence of different variables on the effectiveness of the separation is illustrated by means of curves, and it is shown that there is no limiting mol. wt. above which separation becomes impracticable. These conclusions may be extended to the analogous case of fractional pptn. The effect of repeated fractionation on the distribution of mol. wts. is considered and illustrated graphically. With repeated fractionation the heterogeneity of the fractions decreases rapidly at first, and then much more slowly, so that a completely uniform fraction could be obtained only by an infinite no. of fractionations. F. J. G.

Molecular size distribution in three-dimensional polymerides. I. Gelation. II. Trifunctional branching units. III. Tetrafunctional branching units. P. J. Flory (*J. Amer. Chem. Soc.*, 1941, **63**, 3083—3090, 3091—3096, 3096—3100).—I. A diagrammatical scheme which facilitates statistical analysis of three-dimensional polymerides is presented. The condition for formation of infinitely large mols. is $\alpha > 1/(f-1)$ where f is the functionality of the branch units and α is the probability of chain branching as opposed to chain termination. Methods of calculating α from the no. of chain units, the ratio of the two types of reactants (*e.g.*, ·OH and ·CO_2H), and the extent of reaction are given. The no.-average mol. wt. need not be very large when the statistical conditions for incipient formation of infinitely large three-dimensional networks are fufilled. Many smaller mols. are interspersed with giant networks. Observed gel points for polymerides of tricarballylic acid with diethylene glycol, adipic and succinic acids are compared with the theoretical crit. points for the formation of infinite networks, and discrepancies are attributed to the formation of some intramol. linkings, no account of which is taken in the theoretical treatment. The results support the hypothesis that gelation is the result of the formation of infinitely large mols. and occurs at $\alpha > 0{\cdot}5$.

II. The distribution of mol. species of various complexities in three-dimensional polymerides in which the chain-branching units are trifunctional has been investigated by statistical methods. Simple single chains (containing no branching units) are always present even at the gel point. A rapid rise in no.-average mol. wt. occurs as the gel point is approached and reaches infinity at $\alpha = 0{\cdot}5$. The simultaneous presence of sol and gel after gelation results from random distribution of branch units in the polymeride. Gelation occurs at $\alpha > 0{\cdot}5$ and the wt. fraction of the sol is given by $(1-\alpha)^2/\alpha^2$. Highly branched species are preferentially converted into gel beyond the gel point, and consequently the average complexity of the sol fraction decreases.

III. The distribution of species in three-dimensional polymerides composed of randomly cross-linked chains of uniform length in which the branching units are tetrafunctional has been investigated statistically. Results are similar to those for trifunctionally branched polymerides. Gelation occurs when the cross-linking index γ (no. of structural units cross-linked per chain) is 1, and the no.-average mol. wt. is twice that of the chains. The effect of non-uniformity in length of chain is discussed. When the chains are randomly distributed in length $\gamma = 0{\cdot}5$ at the gel point. The theoretical application to vinyl–divinyl copolymerides is briefly discussed. W. R. A.

Double refraction of flow studies with methyl methacrylate polymerides in solution. A. J. de Rosset (*J. Chem. Physics*, 1942, **9**, 766—774).—An apparatus for the measurement of double refraction of flow is described. The vortical angle, double refraction of flow, and viscosity (η) of dioxan solutions (1—50 g. per l.) of a series of CH_2:CMe·CO_2Me polymerides have been measured at 25°. In all cases the birefringence (S) is $\propto$ the velocity gradient (v). For dil. solutions S per unit of v per unit η varies linearly with concn. From the vortical angle measured in dil. solution the rotary diffusion const. for each polymeride is deduced and the lengths of the polymeride mols. are calc. as 890—1880 A. The shape and structure of the polymeride mols. are discussed and tentative vals. of the mol. wts. and length/width ratios (r) are assigned. The sp. η increment at infinite dilution varies linearly with r^2, in accord with theory. J. W. S.

Coagulation of hydrophobic sols by electrolyte mixtures. IV. Electrophoretic mobility of the negative silver iodide sol in electrolyte mixtures. L. Lepin and A. Bromberg (*Acta Physicochim. U.R.S.S.*, 1940, **16**, 139—158).—The cataphoretic mobility (U) of a dil. negative AgI sol in solutions of K_2SO_4, KNO_3, $MgSO_4$, $Mg(NO_3)_2$, $Ce_2(SO_4)_3$, and $[Co6NH_3](NO_3)_3$, and their mixtures, has been studied. With increasing concn. of any one salt, U decreases smoothly, and more rapidly the greater is the valency of the cation. On the other hand, with a given cation the decrease of U is less rapid the greater is the valency of the anion. In mixtures, increasing concn. of a multivalent electrolyte in presence of a fixed concn. of K_2SO_4 causes a decrease of U which is less rapid the greater is [K_2SO_4]. These effects are parallel to those found in the coagulation of AgI sols by electrolytes (A., 1939, I, 563) and depend in the same way on the valency of the cation and on the ionic strength, except where [as with $K_2SO_4 + Ce_2(SO_4)_3$] complex formation occurs. F. J. G.

Activity-coefficient theory of coagulation of weakly solvated sols. W. Ostwald (*Kolloid-Z.*, 1941, **94**, 169—184).—Several objections to the author's theory (cf., *e.g.*, A., 1939, I, 470) are discussed and replied to, in particular those of Weiser and Milligan (A., 1940, I, 411). F. L. U.

Effect of electrostatic forces on electrokinetic potentials. W. G. Eversole and W. W. Boardman (*J. Chem. Physics*, 1941, **9**, 798—801).—The explanation of electrokinetic phenomena on the basis of the thermal and electrical energy of the ions in a solution near a charged wall and the assumption of an immobilised layer attached to the solid wall are discussed. Vals. of the surface potential of the solid and the thickness of the immobilised layer have been calc. from electrokinetic potentials for 16 solutions. W. R. A.

VI.—KINETIC THEORY. THERMODYNAMICS.

Energy of isomerisation of *cis*- and *trans*-dichloroethylene. R. E. Wood and D. P. Stevenson (*J. Amer. Chem. Soc.*, 1941, **63**, 1650—1653).—The gaseous equilibrium between *cis*- and *trans*-$(CHCl)_2$ has been studied between 185° and 275° with I as catalyst and the val. of $\Delta H°$ for the isomerisation of *cis*-$(CHCl)_2$ has been calc. as 723 g.-cal. per mol. At 0° K. the *cis*-form is more stable than the *trans*- by ~530 g.-cal. per mol. The sum of two unknown $\nu\nu$ of *trans*-$(CHCl)_2$ has been computed by combining equilibrium with spectroscopic and electron diffraction data. W. R. A.

Iodination. I. Equilibrium in systems of iodine and various unsaturated organic compounds in the dark in different non-polar solvents. J. C. Ghosh, S. K. Bhattacharyya, M. M. Dutt, and M. J. Rao (*J. Indian Chem. Soc.*, 1941, **18**, 171—176).—The equilibrium consts. for the reactions I_2 + β-amylene $\rightleftharpoons$ β-$C_5H_{10}I_2$ (at 0° and 30°) and I_2 + α-pinene $\rightleftharpoons$ $C_{10}H_{16}I_2$ (at 0° and 27°) in CCl_4, C_6H_6, and CS_2 have been determined. They are independent of initial concn. but

depend on the temp. and the solvent. The heats of reaction are −4000 to −6000 and −3000 to −5000 g.-cal., respectively. F. J. G.

Association of benzoic acid in benzene. F. T. Wall and P. E. Rouse, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3002—3005).—The association of BzOH in C_6H_6 has been investigated by a v.p.-lowering method and the dissociation const. for the dimeride is given by $\log K = 3{\cdot}790 - 1977/T$. The heat of dissociation of the dimeride is computed as 9000±400 g.-cal. W. R. A.

Electron-sharing ability of organic radicals. XII. Effect of the radicals on the degree of association of polar molecules. XIII. Effect of the radicals in the solvent molecule. F. A. Landee and I. B. Johns (*J. Amer. Chem. Soc.*, 1941, **63**, 2891—2895, 2895—2900).—XII. The ionisation of the dimeric form of carboxylic acids to $2R{\cdot}C(O^-){:}O \rightarrow H^+$ with rearrangement to $R{\cdot}C(:O){\cdot}OH$ will occur less with weak than with strong acids. The association of AcOH, Pr^aCO_2H, BzOH, $CH_2Cl{\cdot}CO_2H$, $CHCl_2{\cdot}CO_2H$, and $CCl_3{\cdot}CO_2H$ in the vapour state and in Et_2O has been investigated; it decreases as the electron-sharing ability of the radical increases.

XIII. The normalising effect of a solvent is due to the association of the solvent with the solute. The electron-sharing ability of the radicals in a series of ketones determines their normalising power on BzOH and EtOH but their dielectric consts. have little, if any, effect on association by H-bonding. W. R. A.

Ionisation constant of HCO_3' from 0° to 50°. H. S. Harned and S. R. Scholes, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 1706—1709).—The e.m.f. of the cell $H_2|Na_2CO_3(m_1)$, $NaHCO_3(m_2)$, $NaCl(m_3)|AgCl–Ag$ has been measured from 0° to 50° at 5° intervals and ionisation consts. of HCO_3' have been evaluated. Equations for thermodynamic functions are derived and the vals. of these functions at 25° are: ΔH 3600 g.-cal.; ΔC_p −65 g.-cal. per degree; ΔS −35·16 g.-cal. per degree. The expression for ΔG^0 is $13278{\cdot}55 - 29{\cdot}7286T + 0{\cdot}10884T^2$. W. R. A.

Constitution of dilute soap solutions. IV. Hydroxyl ion activity of sodium laurate solutions at 20°. P. Ekwall and L. G. Lindblad (*Kolloid-Z.*, 1941, **94**, 42—57).—The OH′ activity of Na laurate (NaL) solutions was determined with a glass electrode in the concn. range 0·001—0·18N. The hydrolysis const. (K_h)-concn. curve consists of several sections representing various equilibria. Below 0·006N. hydrolysis leads to the formation of free HL; at the lowest concns. K_h decreases normally with increasing c, but becomes const. when the liquid is saturated with HL. Immediately above 0·006N. K_h reaches a min., and the separated HL vanishes over a short range of concn. corresponding with the formation of dissolved NaL,HL. At 0·0075N. the latter substance separates and K_h increases, the process being represented as $2L' + H_2O \rightarrow LHL' + OH'$. At 0·021—0·022N. the curve becomes steeper, corresponding probably with $4L' + H_2O \rightarrow LHL_3''' + OH'$. A still steeper rise beyond 0·03N. indicates hydrolysis of medium aggregates, *e.g.*, $(L')_6$. K_h increases less rapidly at 0·035—0·037N. and becomes const. at 0·05—0·06N. These observations are in full agreement with the hydrolysis theory previously put forward (*ibid.*, 1940, **92**, 141), which enables the degree of aggregation to be deduced from measurements of the OH′ activity. Only below 0·006N. is NaL a normal 1—1 electrolyte. Above 0·037N. large aggregates are formed, but association reaches a limit at 0·05N. F. L. U.

Reduction equilibria of zinc oxide and carbon monoxide. E. C. Truesdale and R. K. Waring (*J. Amer. Chem. Soc.*, 1941, **63**, 1610—1621).—Equilibrium data have been calc. from a revised free energy equation, $ZnO(s) + CO(g) = Zn(g) + CO_2(g)$; $\Delta G^\circ = 47557 + 6{\cdot}194T \log T - 0{\cdot}045 \times 10^{-3}T^2 + 0{\cdot}0655 \times 10^5 T^{-1} - 49{\cdot}747T$ and compared with existing experimental data. W. R. A.

Hydration of the ethylenic linkage. I. Equilibrium between *iso*butene, *tert*-butyl alcohol, and water. C. W. Smart, H. Burrows, (Miss) K. Owen, and O. R. Quayle (*J. Amer. Chem. Soc.*, 1941, **63**, 3000—3002):—Measurements of the equilibrium const. (k) for the hydration of *iso*butene (I) at 100° have been made in mixtures of (I) and $Bu^\gamma OH$, respectively, with aq. dioxan containing $HgCl_2$ as catalyst. Vals. of k are in agreement but the error due to free space in the reaction vessel is indeterminate. The average val. of k at 100° is 38. Preliminary measurements with $CEt_3{\cdot}OH$ and $CPr_3{\cdot}OH$ indicate that the % dehydration of $CPr_3{\cdot}OH$ lies between those of $Bu^\gamma OH$ and $CEt_3{\cdot}OH$. W. R. A.

Thermodynamic properties of binary solid solutions.—See A., 1942, I, 92.

Heat of combustion of *cis*- and *trans*-decahydronaphthalene. G. F. Davies and E. C. Gilbert (*J. Amer. Chem. Soc.*, 1941, **63**, 1585—1586).—The isothermal heats of combustion of *cis*- and *trans*-decahydronaphthalene at 25° are, respectively, 10851·3±1·1 and 10836·0±1·0 g.-cal. per g. The standard heat of formation and the heat of isomerisation of the two forms have been calc. W. R. A.

Heats of combustion. I. Heat of combustion of acetone. C. B. Miles and H. Hunt (*J. Physical-Chem.*, 1941, **45**, 1346—1359).—An accurate redetermination of the heat of combustion of $COMe_2$ to CO_2 and liquid H_2O has given the vals. 435·32±0·20 and 427·77±0·26 kg.-cal.[15] for gaseous and liquid $COMe_2$ respectively at 25° and 1 atm. const. total pressure. C. R. H.

Heat contents of bivalent sulphates in extremely dilute aqueous solutions. A. L. Robinson and W. E. Wallace (*J. Amer. Chem. Soc.*, 1941, **63**, 1582—1584).—By a modification of the method of Young *et al.* (A., 1938, I, 616) applied to the heats of dilution of $CaSO_4$, $MgSO_4$, $CdSO_4$, $CuSO_4$, and $ZnSO_4$ it is shown that s, the limiting derivative of the apparent mol. heat content with respect to √concn. (c), has max. val. between $\sqrt{c} = 0{\cdot}02$ and 0·03. The modified method appears to give better agreement with the Debye–Hückel limiting law than previously. W. R. A.

Entropy of mixing and heat of dilution of cellulose triacetate in dioxan. F. Kunze (*Z. physikal. Chem.*, 1940, **A, 188**, 90—98).—The temp.-dependence of the osmotic pressure of dil. solutions of cellulose triacetate in dioxan has been studied, and from the results the entropy of mixing and the heat of dilution have been calc. The entropy of mixing in the more dil. range has the "ideal" val., but increases more rapidly than this with increasing concn. It is suggested that this corresponds with an increased no. of configurations resulting from change of place between solvent mols. and individual chain-members of the long-chain solute mols. The heat of dilution is positive at concn. <6·22 g. per l., but becomes negative at higher concn. This and the abnormally high temp.-dependence of the osmotic pressure indicate association. F. J. G.

Anhydrous sodium soaps. Heats of transition and classification of phases. R. D. Vold (*J. Amer. Chem. Soc.*, 1941, **63**, 2915—2924).—The transition temp. and heats of transition of the series of soap phases, curd-fibre, subwaxy, waxy, superwaxy, neat, and isotropic liquid of Na laurate (I), myristate (II), palmitate (III), stearate (IV), and oleate (V) have been investigated using a new differential calorimeter capable of measurements up to 340°. For (II), (III), and (IV) similar heat effects are observed and indicate that similar changes in structure are involved. The behaviour of (IV) and (V) suggests that the structural changes do not occur in the same order as for (I), (II), and (III). At the transitions from curd → subwaxy and subwaxy → waxy the heat effect is large and varies with chain length. At high transition temp. the heat effect is small and relatively independent of chain length. The low-temp. transitions are probably due to rearrangement of the C chains whilst the high-temp. changes are attributed to rearrangement of the polar heads of the mols. W. R. A.

Kinetics and rapid thermochemistry of carbonic acid.—See A., 1942, I, 104.

VII.—ELECTROCHEMISTRY.

Elimination of liquid junction potentials. III. Comparison of the silver–silver chloride and silver–silver bromide electrodes at 25°. B. B. Owen and E. J. King (*J. Amer. Chem. Soc.*, 1941, **63**, 1711—1712).—The standard potentials of the Ag–AgCl and Ag–AgBr electrodes have been compared by means of the cell $Ag–AgBr|KBr(x)m$, $KNO_3(1-x)m|KNO_3(1-x)m$, $KCl(x)m|AgCl–Ag$ at 25°. The difference between these potentials is 0·15100 v. in good agreement with vals. for cells without liquid junctions. The method employed (cf. A., 1938, I, 624) is fundamentally sound provided that the ionic strength is not too high. W. R. A.

Overvoltage of hydrogen on lead in the presence of surface-active organic compounds. L. Vaniukova and B. Kabanov (*J. Phys. Chem. Russ.*, 1940, **14**, 1620—1625).—The H overvoltage on spongy Pb in 2—8N-H_2SO_4 is raised by org. additions. The increase is independent of the c.d. Substituted NH_4 compounds cause the highest increase, *e.g.*, *iso*-C_5H_{11} 0·46 v. in 0·002M. solution, Bu 0·26 v. in 0·001 M., and Pr 0·15 v. in 0·01M. solution. Sulphates of $(NMe_3{\cdot}CH_2{\cdot})_2$, $NPhMe_2$, benzylpyridine, β-naphthaquinoline, and acridine cause an increase of 0·01—0·35 v. Hexoic acid, $C_7H_{15}{\cdot}OH$, and other aliphatic substances are less active. No definite mechanism of the effect is suggested. J. J. B.

Europium and ytterbium in rare earth mixtures. Polarographic determination.—See A., 1942, I, 114.

Polarographic reduction of osmium tetroxide. W. R. Crowell, J. Heyrovsky, and D. W. Engelkemeir (*J. Amer. Chem. Soc.*, 1941, **63**, 2888—2890).—The polarographic reduction of OsO_4 in saturated solutions of $Ba(OH)_2$ and $Ca(OH)_2$ at 25° has been investigated using the dropping Hg electrode, and compared with K_2OsO_4 in a saturated solution of $Ca(OH)_2$. The current–voltage curves for OsO_4 show three waves and the three steps in the reduction are considered to correspond, respectively, with $HOsO_6' \rightarrow OsO_4'' + OH'$, $OsO_4'' + 2H_2O \rightarrow OsO_2 + 4OH'$ (I), and $2OsO_2 + H_2O \rightarrow Os_2O_3 + 2OH'$ (II). The half-wave potentials of (I) and (II) are −0·44 v. and −1·20 v. (against the normal calomel electrode), respectively. The current–voltage curve of K_2OsO_4 shows waves corresponding with the last two found with OsO_4. W. R. A.

VIII.—REACTIONS.

Unsensitised slow combination of hydrogen and oxygen between the second and third explosion limits in the temperature range 500—560°. F. S. Dainton (*J. Chem. Physics*, 1941, **9**, 826—827).—Polemical against Oldenburg and Sommers (A., 1941, **I**, 302). W. R. A.

Theory of displacements of mixtures giving maximum flame velocities. A. R. T. Denues (*J. Amer. Chem. Soc.*, 1941, **63**, 1757—1758; cf. A., 1941, I, 270).—Relations have been derived between the displacements of mixtures giving max. flame velocities for H_2 and for CO and the composition of the atm. used for combustion. W. R. A.

Carbon monoxide–oxygen flame. VII. OH radical in flames of moist carbon monoxide. H. Kondrateeva and V. Kondrateev (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 1—8).—The presence of OH has been detected in flames of moist CO and O_2 at 10—62·5 mm., the partial pressure of OH being $\sim 4 \times 10^{-3}$ mm., *i.e.*, ~100 times the equilibrium concn. The rate of production of OH is approx. the reaction rate, confirming that it plays an essential part in the reaction. F. J. G.

Radiation of the flame of carbon monoxide and ozone, and the mechanism of this reactions. M. Zatziorski, V. Kondrateev, and S. Solnischkova (*J. Phys. Chem. Russ.*, 1940, **14**, 1521—1527).—When a mixture of CO and O_2 containing 3·5% of O_3 passes through a quartz tube at atm. pressure, the decomp. of O_3 becomes noticeable at 120—130° and quant. at 250°, but the % of CO oxidised is low (0·2—1%) and decreases when the temp. rises; this negative temp. coeff. is probably due to the low average $[O_3]$ at higher temp. The spectrum of the CO + O_3 flame at 150—250° is identical with that of the CO–air flame except that the former shows no OH bands. The luminosity of the flame increases with temp.; if the mol. collisions extinguishing the luminescence are taken into account, it is calc. that at 150° 1 in 10^3 of the CO_2 mols. formed is excited, and at 250° 1 in 20—30. Excited CO_2 mols. can be produced only in the reaction $CO + O \rightarrow CO_2$ but ordinary CO_2 is formed also directly from CO and O_3 in a reaction the activation energy of which seems to be ~20 kg.-cal. J. J. B.

Propagation of the cool flame in combustible mixtures containing 0·03% of carbon disulphide. N. Semenov and V. Voronkov (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 831—878).—Cool-flame propagation in O_2–N_2 mixtures containing 0·03% of CS_2 has been investigated. As $[O_2]$ decreases, the region of propagation extends to lower temp. The rate of flame propagation increases with temp. and increases rapidly with increase in pressure to a max. at ~50 mm. Hg, following which the rate gradually decreases. Equations for the influence of pressure and temp. on the rate of propagation and for the limits of self-ignition and flame propagation have been derived and satisfactorily applied to the experimental data. C. R. H.

Inflammability of ether–oxygen–helium mixtures. Their application in anæsthesia. G. W. Jones, R. E. Kennedy, and G. J. Thomas (*U.S. Bur. Mines*, 1941, *Rept. Invest.* 3589, 15 pp.).—The $[O_2]$ in Et_2O–O_2–He mixtures must be kept < ~16% in the range of mixtures usually employed in anæsthesia if explosion hazards are to be eliminated. The addition of He to Et_2O–O_2 mixtures therefore offers some difficulty if strictly non-inflammable mixtures are demanded. There is, however, a considerable range of mixtures in which, although flame was propagated slowly upward through the test apparatus, no explosive violence was produced. The range and composition of these mixtures are shown graphically, and their use under certain conditions is recommended. Preliminary experiments on the inflammability and clinical use of *cyclo*propane–O_2–He mixtures indicate that the addition of 5% or more of Et_2O to non-inflammable mixtures of *cyclo*propane–O_2–He in the upper limit range does not bring the mixtures back again into the inflammable range. H. C. M.

Ignition conditions of gas mixtures. XVI. Effect of peracetic acid on the cold-flame oxidation of acetaldehyde. B. V. Aivazov, N. P. Keier, and M. B. Neiman (*J. Phys. Chem. Russ.*, 1940, **14**, 1535—1549).—Mixtures of MeCHO and O_2 can burn with a red flame when $[O_2]$: [MeCHO] is > 0·25 or with a cold flame when $[O_2]$: [MeCHO] is > 0·085. For a mixture $[O_2]$: [MeCHO] = 0·75 the zone of a slow oxidation lies below the line 180 mm. Hg at 205°, 60 mm. at 235°, and 50 mm. at 280°, and the zone of red flame above 140—150 mm. at 210—220° and 260 mm. at 250—300°. Between these zones three regions of cold flame are situated. In the first (220—250° at 100 mm.), after the induction period τ, an ignition takes place, and the pressure p after ignition is > before. In the second (250—280° at 100 mm.) after a short induction period and ignition p is < before. In the third, at higher temp., two ignitions occur. In the zone of slow oxidation the rate of reaction is $\propto p^{0.56}\exp.(-15{,}600/RT)$; it is raised by AcO_2H, *e.g.*, five times when 2·3 mm. of AcO_2H are added to 83 mm. of MeCHO + 0·75 O_2. During the induction period of the cold flame oxidation $[AcO_2H]$ in the reaction mixture increases. τ is the smaller the higher are p and the ratio [MeCHO] : $[O_2]$. It is reduced by an addition of AcO_2H, *e.g.*, from 3·5 sec. to 1 sec. when 4 mm. of AcO_2H are added to 56 mm. of MeCHO + 0·75 O_2. AcO_2H explodes above 275° at 8 mm. and above 340° at 2 mm.; addition of 1·67 CO_2 per 1 mol. of AcO_2H reduces the explosion temp. at these pressures to 240° and 290°, respectively. The strong influence of an inert gas shows that the explosion of AcO_2H is a chain reaction and has no thermal character. The oxidation of MeCHO gives first AcO_2H; $[AcO_2H]$ increases exponentially with time until the concn. at which AcO_2H explodes is reached. This explosion is the cold flame of MeCHO. This theory accounts for the magnitude of τ and its variation with the amount of AcO_2H added. J. J. B.

Carbon dioxide reduction. A. F. Semetschkova and D. A. Frank-Kamenetzki (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 879—898).—The primary step in the reaction $CO_2 + C \rightarrow 2CO$ over the range 600—900° and for pressures 50—200 mm. Hg is $CO_2 + C \rightarrow CO + (CO)$, where (CO) denotes chemisorbed CO. This step occurs on the free C surface and requires activation in the gas phase, the energy of activation being 26—27 kg.-cal. Its independence of surface conditions leads to the assumption that it is really the energy possessed by a mol. in the gas phase. The reaction is inhibited by (CO). The binding energy of (CO) is strongly affected by surface conditions and especially by the presence of mineral admixtures. C. R. H.

Thermal decomposition of methyl *n*-butyl ether. S. J. Magram and H. A. Taylor (*J. Chem. Physics*, 1941, **9**, 755—761).—The thermal decomp. of $MeOBu^n$ at 480—560° is analogous to that of other ethers, and there is no evidence of the formation of MeOH and C_2H_4 by ring-closure through a H-bond. In the primary decomp. 58—63% yields CH_4 and Pr^nCHO and the remainder CH_2O, C_2H_4, and C_2H_6. The decomp. of the Pr^nCHO and CH_2O is rapid compared with the primary reaction, suggesting that it is induced by radicals from the ether. The energy of activation of the primary

reaction is 54·0 and 56·6 kg.-cal. per g.-mol. at 200 and 100 mm. pressure, respectively, but is increased to ~60 kg.-cal. per g.-mol. for the NO-inhibited reaction. The constancy of the activation energies of both normal and inhibited reactions for a series of others suggests that the mechanism is similar in each case. J. W. S.

Dissociation of tetraphenylhydrazine and its derivatives. G. N. Lewis and D. Lipkin (*J. Amer. Chem. Soc.*, 1941, **63**, 3232—3233).—Polemical against Cain and Wiselogle (A., 1940, I, 325). W. R. A.

Exchange reaction between hydrogen and deuterium in heterogeneous systems. L. V. Kortschagin and M. I. Urizko (*J. Phys. Chem. Russ.*, 1940, **14**, 1566—1568).—Alizarin, *o*-anisidine, and *o*-toluidine (**I**) when shaken with H_2O containing D_2O exchange 2 H per mol.; dimethylglyoxime exchanges 8 H showing tautomerism involving the Me groups. Kinetic experiments on the exchange between D_2O and (**I**) gave no definite results. J. J. B.

Coulombic energy of activation. E. S. Amis (*J. Amer. Chem. Soc.*, 1941, **63**, 1606—1609).—The two ways of measuring the energy of activation of a reaction depend on whether the temp. coeff. of the reaction rate is measured (*a*) in a solvent of const. composition or (*b*) in isodielectric solvents. With (*a*) ϵ varies and the temp. coeff. includes not only the increased energy of the reactants due to pure thermal effect but the changed effect of the solvent on the reactants. The conditions for ionic reactions are discussed on the assumption that the effect of the solvent is due mainly to an influence on the coulombic forces between the electrically charged particles. Influences of electrostatic forces on reaction rates as a function of ϵ of the solvent can be interpreted by measurement of the energies of activation in isodielectric media, and the part of the energy of activation which changes in isodielectric media is assumed to be the coulombic energy. The change of energy of activation between the different ionic type reactants in various solvents is a change in the coulombic energies of the ions down to ϵ 40. At $\gtrsim$40 the calc. changes of coulombic energies are progressively > observed changes in energies of activation as ϵ is lowered. W. R. A.

Effect of solvation on the kinetics of bimolecular reactions in solution. V. A. Holzschmidt (*Acta Physicochim. U.R.S.S.*, 1940, **16**, 25—42).—The effect of solvation on the rate of a bimol. reaction in solution is considered in the light of the theory of the transition state. It is concluded that normal vals. of the non-exponential factor will be obtained if the mols. react in that form in which they are present in the largest amount: *i.e.*, as solvates if strongly solvated or as unsolvated mols. if only slightly solvated. An increased val. of *B* results if normal mols. of a strongly solvated substance react, and a decreased val. of *B* if solvated mols. of a slightly solvated substance react. F. J. G.

Rate of oxidation of sulphite ions by oxygen. E. C. Fuller and R. H. Crist (*J. Amer. Chem. Soc.*, 1941, **63**, 1644—1650).—Factors affecting the rate of reaction of Na_2SO_3 solutions saturated with O_2 at 1 atm. have been investigated. The rate depends directly on [Cu^{++}] when this is $>10^{-6}$M., the Cu^{++} ions acting as a positive catalyst. Mannitol (**I**) acts as a negative catalyst and its inhibitory effect is uniform over a 10^5-fold change in the concn. of (**I**). Without catalysts the reaction is of first order with respect to [SO_3''] and the sp. reaction rate is 0·013 sec.$^{-1}$ at 25°. The effect of p_H depends on the p_H range; at p_H 8·2—8·8 the rate is independent of p_H. It decreases between 5·9 and 3·2 in a complicated way suggesting that it depends on [SO_3''] and on [H^+]$^{\frac{1}{2}}$ but not on [HSO_3']. The data are discussed in terms of chain mechanisms resulting from reduction of O_2 and oxidation of SO_3'' ions but no mechanism which will account for all the observed data has been found. W. R. A.

Dielectric and solvent effects on the iodide–persulphate reaction. E. S. Amis and J. E. Potts, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 2883—2888; cf. A., 1941, I, 475).—Rate coeffs. (*k*), activation energies (*E*), and frequency factors (*B* of the Arrhenius equation) have been determined for the reaction between I' and S_2O_8'' in isodielectric (**I**) and isocomposition (**II**) EtOH–H_2O media at 20°, 30°, and 40°. The salt effect of KNO_3 in (**I**), ϵ = 69·00, agreed with predictions of the Debye–Hückel limiting law for $\mu^{\frac{1}{2}} < 0{\cdot}212$; *E* and *B* increase with rise in temp., and decrease with increasing $\mu^{\frac{1}{2}}$. An equation is derived for calculating differences of *E* and *B* in (**I**) of specified ϵ, and in (**II**) of const. ϵ, and indicates that electrostatic influences predominate in this reaction. W. R. A.

Kinetics and rapid thermochemistry of carbonic acid. F. J. W. Roughton (*J. Amer. Chem. Soc.*, 1941, **63**, 2930—2934).—The rate of heat evolution when HCl is mixed with $NaHCO_3$ has been studied by the thermal method of measuring the velocity of rapid chemical reactions. The heat is evolved in two stages, the first almost instantaneously owing to combination of H^+ and HCO_3' and the slower second stage owing to decomp. of H_2CO_3 to CO_2 and H_2O. The velocity coeff. of the reaction $H_2CO_3 \rightarrow CO_2 + H_2O$ has been evaluated for 4 temp. and increases markedly with rise in temp. Vals. of the heats of the reactions $H^+ + HCO_3' \rightarrow H_2CO_3$ and $H_2CO_3 \rightarrow CO_2 + H_2O$, the equilibrium const. of the reaction $CO_2 + H_2O \rightleftharpoons H_2CO_3$, and the true first ionisation const. of H_2CO_3 have been deduced. Preliminary measurements have also been made on the rate of dissociation of free $NH_2{\cdot}CO_2H$ and the ionisation of its CO_2H group. W. R. A.

Hydrolysis of dichloroacetic acid. F. Kunze (*Z. physikal. Chem.*, 1941, **A, 188**, 99—108).—The velocity of hydrolysis of $CHCl_2{\cdot}CO_2H$ (**I**) at 75—125° and in presence of various electrolytes has been studied. Practically only the anion reacts, and the reaction is unimol. when referred to it. The energy of activation is 31,400 g.-cal., and this rather high val. is the cause of the greater stability of (**I**) as compared with $CH_2Cl{\cdot}CO_2H$ and $CCl_3{\cdot}CO_2H$. F. J. G.

Rate of inversion of sucrose as a function of the dielectric constant of the solvent. C. J. Plank and H. Hunt (*J. Physical Chem.*, 1941, **45**, 1403—1415).—Data for the inversion of sucrose by HCl in dioxan–H_2O mixtures show that the reaction coeff. (*k*) increases with increase in concn. of dioxan, the change closely corresponding with $\log k/k_0 = 11{\cdot}6(1/D - 1/D_0)$ where *D* is the dielectric const. and the subscript 0 refers to vals. in H_2O. If $k_s = k$ calc. with reference to the concn. of sucrose in the H_2O contained in the dioxan–H_2O mixtures, then k_s passes through a min. with increase in *D*. The change in *k* with [HCl] is > that expected if reaction rate $\propto$ [HCl]. The sp. rotation of invert sugar decreases sharply in proportion to the wt.-% of dioxan in the solvent, the val. in 80% dioxan being <0·33 of the val. in H_2O. C. R. H.

Polymerisation of styrene in thymol solution. J. K. Moore, R. E. Burk, and H. P. Lankelma (*J. Amer. Chem. Soc.*, 1941, **63**, 2954—2957).—The rate of polymerisation (*k*) of purified styrene in the antioxidant, thymol, has been investigated at 100° and 140°. *k* follows a third-order law which is attributed to a second-order chain-initiating action and a first-order chain-terminating mechanism. The energy of activation is 21,800 g.-cal., and the average mol. wt. of the polymeride is ~1000. No period of induction was observed. Thymol acted as a mild catalyst. No evidence for a free radical mechanism for the polymerisation was found. W. R. A.

Reaction velocities at low temperatures. IV. Ionisation of nitroethane at temperatures between −32° and 20°. R. P. Bell and A. D. Norris (*J.C.S.*, 1942, 854—856).—The velocity coeffs. for the reaction between NaOH and $EtNO_2$ in 80% aq. MeOH over the temp. range studied can be expressed by the simple Arrhenius equation. The data give no indication of the "tunnel effect," but data at even lower temp. would probably provide a crucial test for this effect. C. R. H.

Rate and equilibrium studies of carbinol formation in triphenylmethane and sulphonephthalein dyes. S. Hochberg and V. K. LaMer (*J. Amer. Chem. Soc.*, 1941, **63**, 3110—3120).—The rate (*k*) and equilibrium (*K*) consts. for the formation of the carbinols of the sulphonephthalein dyes, bromophenol-red, bromocresol-purple, and bromocresol-green, have been determined colorimetrically in H_2O and in isodielectric H_2O–MeOH media at 25°, 35°, and 45° and compared with existent data for bromophenol-blue. The bimol. mechanism of carbinol formation has been verified at 25° for crystal-violet by conductance measurements. The decomp. of the carbinol to regenerate the coloured form of the dye involves a mol. of H_2O. Energies of activation (*E*) and frequency factors are const. over the range of temp. studied. *k* for *m*-substituted sulphonephthaleins is in the same order as for the "substituent const." as applied to C_6H_6, and *k* is affected only by changes in *E*, the entropy of activation (*S*) remaining const. *o*-Substitution involves changes in *E* and *S*. At const. temp. (*T*), $\log k \propto 1/\epsilon$ on the mol. fraction scale. The dependence

of K on T and ϵ in isocomposition media of const. ϵ is discussed on the electrostatic theory. Vals. of k are compared with predictions from the collision theory and it is thought that substituents in the *o*-position affect S through vibrational and rotation partition functions rather than through the translational partition functions. W. R. A.

Diffusion and kinetics of heterogeneous reactions. D. A. Frank-Kamenetzki (*Acta Physicochim. U.R.S.S.*, 1940, **16**, 9—12).—Mathematical. Expressions for the net rate of reaction between a gas or a solute and a solid are derived for the region in which neither diffusion nor the true reaction rate may be neglected. These take specially simple forms when the reciprocals of the rates of the observed reaction, the true surface reaction, and the diffusion process are introduced. F. J. G.

Reactivity of amalgams. H. A. Liebhafsky and A. F. Winslow (*J. Amer. Chem. Soc.*, 1941, **63**, 3137—3142).—With violent agitation the rate of oxidation (k) of Zn amalgams is practically independent of [Zn] and is limited by the rate at which fresh amalgam surface is exposed. If this rate is kept const. k is approx. $\propto$ the concn. of oxidising agent and is almost independent of temp. That two elementary processes, electron capture by the oxidising agent and expulsion of the resultant positive charges as Zn ions, are involved is borne out by the oxidation of Pb, Tl, Cd, Sn, and Cu amalgams. Qual. results for Na, Mg, and Al amalgams support these conclusions. Thus, removal of dissolved base metals from Hg by oxidation becomes progressively easier as their concn. decreases. The increment in $\log k$ for oxidation by O_2 is $\propto$ increment in the standard electrode potential of the dissolved base metal and, hence, k appears to be $\propto$ decrease in free energy for the reaction. This is similar to the relationship in overvoltage studies between current and applied voltage, and the inertness of the amalgams to H^+ ions is another similarity to overvoltage. The penetration of a potential barrier by electrons, postulated to explain overvoltage, appears to occur in the oxidation of amalgams. No relationship between k and electrode potential was found although it is believed that such a relationship exists. W. R. A.

Surface conditions of precipitates and rate of reaction. IV. Reduction of mercurous chloride by hydroxylamine. T. H. James (*J. Amer. Chem. Soc.*, 1941, **63**, 1601—1605).—Although it would appear improbable from the mol. type structure and low electrical conductivity of Hg_2Cl_2 that interstitial $Hg_2^{\cdot\cdot}$ could pass through the crystals or that the Gurney–Mott mechanism could operate in the reduction of the compound, it has been shown that Hg_2Cl_2 is reduced by NH_2OH in a manner similar to the reduction of AgCl. The influences on the rate of reduction of pptd. Hg_2Cl_2 of (i) the age of the ppt., (ii) adsorbed dyes and gelatin, (iii) $[NH_2OH]$, and (iv) variation in the concn. of excess of Cl' have been studied. W. R. A.

Effects of heat on dry proteins. I. Kinetics of formation of insoluble ovalbumin. F. W. Bernhart (*J. Physical Chem.*, 1941, **45**, 1382—1387).—The kinetics of the reaction which results in formation of insol. ovalbumin (I) from dry sol. (I) are essentially the same as those which describe autocatalytic reactions. The calc. activation energy for the reaction is 33 kg.-cal. per mol., a val. of the same order of magnitude as that (35 kg.-cal. per mol.) calc. for the heat-denaturation of (I) in solution after consideration of the influence of heats of ionisation on the observed vals. for the activation energy of denaturation. C. R. H.

Theoretical calculations for explosives. Temperatures, gaseous products, and effects of changes in carbonaceous material. —See B., 1942, I, 56.

Pyrolysis of formaldoxime. H. A. Taylor and H. Bender (*J. Chem. Physics*, 1941, **9**, 761—765).—The thermal decomp. of $CH_2{:}N{\cdot}OH$ at 350—415° to yield HCN and H_2O is of the first order and has activation energy 39 kg.-cal per g.-mol. The products react more slowly to yield mainly CO and NH_3, with some N_2, H_2, C_2H_6, and unsaturated compounds. The reaction is probably heterogeneous on a clean glass surface. It is accelerated by traces of air or NO. It is suggested that in the NO-inhibited decomp. of org. compounds, Me radicals form MeNO complexes, which by isomerisation yield $CH_2{:}N{\cdot}OH$. J. W. S.

Thermal reactions promoted by diacetyl. F. O. Rice and W. D. Walters (*J. Amer. Chem. Soc.*, 1941, **63**, 1701—1706).—A small amount of Ac_2 accelerates the decomp. of $COMe_2$ at 526°, presumably because Ac_2 acts as a source of free radicals near 500°. This acceleration causes more rapid formation of keten but is dependent on pressure. A chain mechanism is proposed: $Ac_2 \rightarrow 2Me + 2CO$; $COMe_2 \rightarrow 2Me + CO$; $Me + COMe_2 \rightarrow CH_4 + CH_2{\cdot}COMe$; $MeCO{\cdot}CH_2 \rightarrow Me + CH_2{:}CO$; $Me + CH_2{\cdot}COMe \rightarrow COMeEt$. Small amounts of Ac_2 accelerate the decomp. of Et_2O, MeCHO, and EtOH and, also, the polymerisation of C_2H_4. W. R. A.

Joint action of tetralin hydroperoxide and nitro-compounds on the polymerisation of chloroprene. E. Tschilikina and S. Medvedev (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 293—302).—*o*-, *m*-, and *p*-$C_6H_4(NO_2)_2$, and *p*-$NO_2{\cdot}C_6H_4{\cdot}NH_2$ increase the rate of polymerisation of chloroprene in presence of tetralin hydroperoxide (I). The effect is not simply related to the dipole moment of the NO_2-compound. By determination of the % of insol. material at various stages of the polymerisation it has been shown that the activation by $NO_2{\cdot}C_6H_4{\cdot}NH_2$ occurs through an increase in the rate of the primary linear polymerisation process, the rate of the secondary branching process remaining const. It is suggested that the true initiator of the process may bo a mol. of the form $R{\cdot}N(OH)(OOR') \rightarrow O$, produced by interaction of the NO_2-compound and (I). J. W. S.

Transition stages in catalysis. IV. Kinetics and thermodynamics of the transition stages of the homogeneous catalytic decomposition of hydrogen peroxide. N. I. Kobozev and E. E. Galbreich (*J. Phys. Chem. Russ.*, 1940, **14**, 1550—1565).—The rate v of decomp. of H_2O_2 in presence of $K_2Cr_2O_7$ $\propto$ $[K_2Cr_2O_7]$ between 0·002 and 0·009M. At 25° it changes during one experiment according to the first order, but at 0° the unimol. coeff. increases, and at 56° (vapour of $COMe_2$) decreases in the course of an experiment; at 56° the reaction appears to be of the second order. This behaviour can be accounted for if Cr_2O_9'' is the intermediate product, and $v \propto [Cr_2O_9'']$; then $v = kK[Cr_2O_7''][H_2O_2]^2/(1 + K[H_2O_2]^2)$, K being the equilibrium const. of $2H_2O + Cr_2O_9'' \rightleftharpoons Cr_2O_7'' + 2H_2O_2$. From the temp. coeff. of K the heat of the reaction $Cr_2O_7 \rightarrow Cr_2O_9$ is calc. as 2700 g.-cal. HNO_3 (0·001—0·005N.) reduces v at first, and strongly increases it near the end of the decomp. of H_2O_2, so that a max. val. of v is reached. When v begins to rise, the conductivity of the solution rises also. The max. val. of v occurs at a higher degree of decomp. when the temp. is lower. In acid solution the ion HCr_2O_9' is the catalyst; its heat of formation from H^+, Cr_2O_7'', and $2H_2O_2$ is calc. to be 17,600 g.-cal. HCr_2O_9'' is ~5 times as efficient as a catalyst as is Cr_2O_9''. Contrary to an assumption by Eyring, the entropies of the intermediate products are very different from those of the final products. J. J. B.

Persulphate–iodide reaction. II. Critical increment, and catalysed reaction in presence of neutral salts. W. J. Howells (*J.C.S.*, 1941, 641—645).—E for the reaction is 12,840 g.-cal., and the probability factor is $\sim 10^{-4}$. E increases appreciably with increase of ionic strength, but is unaffected by interchange of cations. The catalytic effects of $Fe^{\cdot\cdot\cdot}$ and $Cu^{\cdot\cdot}$ ions are in qual. agreement with Brönsted's theory. F. J. G.

Catalytic effect of water on aminolysis of ethyl phenylacetate in *n*-butylamine. P. K. Glasoe, L. D. Scott, and L. F. Audrieth (*J. Amer. Chem. Soc.*, 1941, **63**, 2965—2967).—The catalytic effect of H_2O on the aminolysis of $CH_2Ph{\cdot}CO_2Et$ in aq. NH_2Bu^a at 25° has been demonstrated and is attributed to the formation of $Bu^aNH_3^+$ and OH' ions by interaction of H_2O with NH_2Bu^a. The prep. of *phenylacet-n-butylamide*, m.p. 57°, from $CH_2Ph{\cdot}CO_2Et$ and NH_2Bu^a is described. W. R. A.

Oxidation of phospholipins in presence of ascorbic acid and carcinogenic chemicals.—See A., 1942, III, 255.

Kinetics of *para–ortho* hydrogen conversion on charcoal. R. Burstein (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 201—208; cf. A., 1939, I, 87).—The rate (v) of the *para–ortho* conversion of H_2 at a charcoal (I) surface at 90° K. has been studied by the thermal conductivity method. On pure (I), outgassed at 950°, v is almost independent of $[H_2]$, indicating that the reaction proceeds primarily on active centres of the first kind. On (I) poisoned by adsorption of a definite amount of H_2 at 500°, v is almost independent of $[H_2]$ at low $[H_2]$ but at high $[H_2]$ $v \propto [H_2]$. The results permit explanation of the apparent discrepancies previously observed between the

activation energies as determined by the static and dynamic methods. J. W. S.

Alkali and alkaline-earth metals as catalysts in the hydrogenation of organic compounds. F. W. Bergstrom and J. F. Carson (*J. Amer. Chem. Soc.*, 1941, **63**, 2934—2936).—Org. compounds which form additive compounds with alkali or alkaline-earth metals can be catalytically hydrogenated by high-pressure H_2 using the metal as catalyst. With Na as catalyst hydrogenation occurred at 170—250° except with C_5H_5N which was reduced at 130—150°. Ca behaves similarly to Na but less tar and resin are formed. H_2 in presence of Ca does not reduce C_6H_6. Some of the hydrogenation using Na appears to be due to hydrogenolysis of the additive compound formed with Na since NaH was detected and must exhibit sp. catalytic activity in hydrogenation (cf. Hugel *et al.*, A., 1932, 819). The mechanism of hydrogenation is discussed. W. R. A.

Mechanism of the catalytic dehydration and dehydrogenation of alcohols of the homologous series C_nH_{2n+1}·OH. XII. A. Bork (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 899—920).—From an examination of published data it is shown that Dohse's observation that the activation energy of the catalytic dehydration of alcohols is reduced as Me groups are introduced also holds for dehydrogenation reactions. The velocity of dehydration of alcohols of the series follows Arrhenius' exponential law. The pre-exponential term in the Arrhenius equation depends on the catalytic surface, the life period of the reacting mol., and steric factors. The reaction mechanism at the surface of the catalyst is discussed. C. R. H.

Restricted and accelerated autoxidation of (*a*) ethers and unsaturated hydrocarbons, (*b*) benzaldehyde in presence of didiphenylene-ethylene.—See A., 1942, II, 49, 54.

Inhomogeneity in co-precipitated copper hydroxide–magnesium hydroxide catalsyts and its effect on their activity. E. H. Taylor (*J. Amer. Chem. Soc.*, 1941, **63**, 2906—2911).—Co-pptd. (i) and reverse co-pptd. (ii) catalysts of the hydroxides of Cu and Mg have been prepared from $Cu(NO_3)_2$ and $Mg(NO_3)_2$ with NaOH and the catalytic activity has been studied by measuring the rate of decomp. of H_2O_2. The activity of (ii) is > that of (i). Centrifuge experiments showed that (i) was inhomogeneous whilst (ii) was homogeneous. Applications of the methods of co-pptn. and reverse co-pptn. for preparing highly efficient promoted catalysts are briefly discussed. W. R. A.

Effect of method of preparation on activity of co-precipitated copper hydroxide–magnesium hydroxide catalysts. J. W. Holmes and E. H. Taylor (*J. Amer. Chem. Soc.*, 1941, **63**, 2911—2915; cf. preceding abstract).—The effects of washing and rate of pptn. of co-pptd. (i) and reverse co-pptd. (ii) catalysts of Cu and Mg hydroxides prepared from $Cu(NO_3)_2$ and $Mg(NO_3)_2$ with NaOH have been studied by measuring their catalytic activity on the rate of decomp. of H_2O_2. Changes in the activity of (i) are comparable with those caused with wide variations in composition. The activity of (ii) is only slightly affected. The results are interpreted in terms of the inhomogeneity of (i). W. R. A.

Catalytic incomplete oxidation of methane with free oxygen.—See B., 1942, I, 19.

[Catalytic] pyrolysis of lower hydrocarbons in presence of methyl chloride.—See B., 1942, 1, 72.

Synthetic corrosion pits and the analysis of their contents. E. D. Parsons, H. H. Cudd, and H. L. Lochte (*J. Physical Chem.*, 1941, **45**, 1339—1345).—Synthetic corrosion pits have been prepared by using as anode or pit bottom the exposed end of an Fe wire passing through a cork at the bottom of a vertical glass tube, and as cathode a flat coil of Cu wire above the glass tube. The portion of the Fe wire outside the glass tube is insulated with paraffin wax. The assembly is immersed in an electrolyte bath, the two wires being connected at a point above the liquid level. Alkaline NaCl was used as electrolyte and the contents of the glass tube were removed and titrated by a micro-potentiometric method. The results show that ion concn. in the glass tube is governed by both diffusion and electric transport, equilibrium existing between the two methods of ionic movement. C. R. H.

Reduction of sulphurous acid at the dropping mercury electrode.—See A., 1942, I, 65.

Electrolytic deposition of copper and silver.—See B., 1942, I, 96.

Synthesis of silver hydrosols by electrolysis.—See A., 1942, I, 56.

Silver plating.—See B., 1942, 1, 55.

Copper–lead alloys [electrodeposited] from ethylenediamine solution.—See B., 1942, 1, 54.

Cyanide zinc-plating baths.—See B., 1942, I, 55.

Cadmium plating.—See B., 1942, I, 55.

Cobalt plating.—See B., 1942, I, 55.

Electrodeposition of tin from acid solutions.—See B., 1942, I, 55.

Alkaline tin plating.—See B., 1942, I, 55.

Electrolysis of magnesium aryl bromides in ethyl ether: behaviour of short-lived aryl free radicals.—See A., 1942, II, 84.

Electrolytic reduction of acetone. Factors influencing pinacol formation in alkaline solution.—See A., 1942, II, 76.

Electrolytic reduction of sorbic acid.—See A., 1942, II, 73.

Electrolytic reduction of benzophenone.—See A., 1942, II, 56.

Corona discharge on liquid dielectrics. Materials responsible for increases in power factor. J. Sticher and J. D. Piper (*Ind. Eng. Chem.*, 1941, **33**, 1567—1574).—A 4-hr. corona discharge on decahydronaphthalene (I) yielded ~1% of gas (mainly H_2), 5% of unsaturated hydrocarbons similar in mol. wt. to (I), and 12% of polymerised hydrocarbons of average mol. wt. 1200. ~82% of (I) remained unchanged. The substance which causes the increase in power factor is an unsaturated, coloured, and insol. constituent of the polymerised hydrocarbons which is formed in very small amounts. It is not necessarily exclusively hydrocarbon and it appears to be held in colloidal suspension. Two possible explanations of why such substances have high power factors are offered but neither is complete. C. R. H.

Decomposition of potassium nitrate in sunlight. T. V. S. Rao and C. Gopalarao (*J. Indian Chem. Soc.*, 1941, **18**, 228—232).—The decomp. of aq. KNO_3 to KNO_2 and O_2 occurs in light of $\lambda > 2900$ A., and is favoured by increasing p_H. F. J. G.

Photo-activity of solids. IX. J. A. Hedvall, G. Borgström, and G. Cohn (*Kolloid-Z.*, 1941, **94**, 57—64; cf. A., 1940, I, 312).—Certain specimens of CdS adsorb phthaleins in darkness from dil. solution to an extent that is considerably reduced when the substrate is illuminated with white light. The effect is due to the nature of the surface of the CdS and can be abolished by previously shaking the CdS with C_5H_5N, which extracts a small amount (*e.g.*, 0·5%) of S. CdS that does not contain extractable S does not adsorb phthaleins in darkness, nor are the latter adsorbed by finely divided S. The effect therefore depends on a loose combination of S in the surface of the CdS; this view is confirmed by the observation that inactive CdS can be rendered active by treatment with $(NH_4)_2S_x$, the product deactivated by extraction with C_5H_5N, and so on indefinitely. Adsorption experiments with various xanthen dyes show that whilst all are adsorbed in darkness only those containing at least one $NAlk_2$ group give decreased adsorption during illumination. The photo-effect is partly reversible, increased adsorption occurring when previously illuminated CdS is placed in darkness, and desorption occurring when the adsorption complex formed in darkness is afterwards illuminated. F. L. U.

Photolysis of simple alkyl esters. J. K. Royal and G. K. Rollefson (*J. Amer. Chem. Soc.*, 1941, **63**, 1521—1525).—No H atoms are produced by photolysis of HCO_2Me or MeOAc. The rate of removal of Bi mirrors by free radicals produced by photolysis of HCO_2Me yields a val. of 6—8 × 10^{-3} sec. for their half-life period compared with 2—3 × 10^{-3} sec. for the free radicals from $COMe_2$. The photolysis of HCO_2Me in a static system yields principally CO, H_2, CH_4, C_2H_6, MeOH, and a very small amount of CH_2O. The total reaction can be represented by a combination of the following: (*a*) $HCO_2Me \rightarrow MeOH + CO$; (*b*) $HCO_2Me \rightarrow 2CO + H_2$; (*c*) $HCO_2Me \rightarrow CO_2 + CH_4$; (*d*) $2HCO_2Me \rightarrow C_2H_6 + H_2 + 2CO_2$. At 50% decomp. the products indicate that the total reaction is 61% of (*a*), 16% of (*b*), 15% of (*c*), and 8% of (*d*). When

NO is added no H_2, CH_4, or C_2H_6 is found among the reaction products. Mechanisms for the four contributory reactions are discussed. W. R. A.

Thermal and photochemical decomposition of oxalyl bromide. J. E. Tuttle and G. K. Rollefson (*J. Amer. Chem. Soc.*, 1941, **63**, 1525—1530).—In both the thermal and the photochemical decomp. of $(COBr)_2$ the products are CO and Br. Throughout the range λ 4358—2652 A. no variation in the nature of the reaction was observed and the quantum yield was slightly <1. Br atoms were present during the course of the reaction. The thermal decomp. is a two-stage process, (i) $(COBr)_2 \rightarrow COBr_2 + CO$, (ii) $COBr_2 \rightarrow CO + Br_2$. Reaction (i) proceeds at ~200° as a homogeneous first-order reaction with an activation energy of 32 kg.-cal. Reaction (ii) is a heterogeneous reaction. W. R. A.

Photolysis of azomethane. C. V. Cannon and O. K. Rice (*J. Amer. Chem. Soc.*, 1941, **63**, 2900—2905).—The quantum yield in the photodecomp. of $(NMe)_2$ (I) at 3660 A. is unity and remains unchanged (*a*) at pressures up to 63 cm., (*b*) by a 4-fold variation in light intensity, and (*c*) by excess of CO_2. The increase in total pressure does not give a measure of the amount of decomp. because (I) appears to decompose by other reactions than those yielding directly N_2 and alkanes. Possible reactions are discussed. W. R. A.

Effect of ultra-violet light on methylcellulose in solution. L. Spitze, A. Mooradian, R. H. Hartigan, and L. A. Hansen (*J. Amer. Chem. Soc.*, 1941, **63**, 1576—1580).—Measurements of η, osmotic pressure, and Cu no. show that the methylcellulose (I) mol. is degraded when aq. solutions are irradiated with ultra-violet radiation from a quartz Hg arc lamp. The mean mol. wt. of (I) is ~50,000. W. R. A.

Photochemical studies. XXXIV. Photochemical decomposition of benzene. J. E. Wilson and W. A. Noyes, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3025—3028).—On irradiation with λ <2000 A. C_6H_6 is decomposed to C_2H_2, H_2, and a solid resembling cuprene. C_6H_6 and D_2 do not combine photochemically. Definite conclusions regarding the mechanism of decomp. are not possible but tentative suggestions are advanced. W. R. A.

Mercury-photosensitised reactions involving benzene and hydrogen. G. S. Forbes and J. E. Cline (*J. Amer. Chem. Soc.*, 1941, **63**, 1713—1716).—C_6H_6 vapour is decomposed by Hg vapour excited by resonance radiation of λ 1849 A. or by unsensitised radiation of <2000 A., but not by Hg excited by resonance radiation of 2537 A. PhOH vapour is, however, decomposed by 2537 A. and the reaction is accelerated by H_2, which seems to be added to aromatic rings because very little H_2O is formed. When mixtures of C_6H_6 and H_2, both at 75 mm. and saturated with Hg vapour at 55°, are exposed to resonance radiation, principally 2537 A., a fairly volatile product was obtained which appears to be a *cyclo*hexadiene yielding, on bromination, 1 : 2 : 4 : 5-tetrabromo*cyclo*hexane. Less volatile products contain H and C in the ratio 0·107, b.p. 233°, and average mol. wt. 160. Dehydrogenation by chloranil gives Ph_2 and hydrogenation in the presence of Adams catalyst showed that 3·4 mols. of H_2 were taken up. The formation of three hydrogenated diphenyls, formed by combinations between the free radicals C_6H_9 and C_6H_7, is postulated and supported by measurements of *n* and ρ. The following reaction mechanism is tentatively put forward: (i) $Hg + h\nu \rightarrow Hg^*$; (ii) $Hg^* + H_2 \rightarrow 2H + Hg$; (iii) $H + C_6H_6 \rightarrow C_6H_7$; (iv) $C_6H_7 + H \rightarrow$ *cyclo*hexadiene (C_6H_8); (v) $C_6H_7 + C_6H_7 \rightarrow C_6H_7{\cdot}C_6H_7$; (vi) $C_6H_9 + H \rightarrow C_6H_{10}$; (vii) $C_6H_9 + C_6H_7 \rightarrow C_6H_9{\cdot}C_6H_7$; (viii) $C_6H_9 + C_6H_9 \rightarrow C_6H_9{\cdot}C_6H_9$. Since very little, if any, phenyl*cyclo*hexadiene is found among the reaction products the reaction $C_6H_6 + C_6H_7 \rightarrow C_6H_5{\cdot}C_6H_7 + H$ is considered to be unimportant. W. R. A.

Photochemical decomposition of rotenone. L. S. Ts'ai and T. S. Ke (*J. Amer. Chem. Soc.*, 1941, **63**, 1717—1718).—From a study of the absorption spectra of solutions of rotenone (I) in EtOH saturated with CO_2 and with O_2 exposed to sunlight, it is concluded that O_2 does not decompose (I) in the dark but in light there is considerable decomp. Since the absorption curves for the solutions treated with CO_2 are only very slightly different from those treated with O_2, O_2 can have little effect on the photo-decomp. of (I). W. R. A.

Behaviour of visual purple at low temperature.—See A., 1942, III, 23.

IX.—METHODS OF PREPARATION.

Polyhydric alcohol- and tartaric acid-copper-alkali complexes.—See A., 1942, I, 40.

Stability and activity coefficients of the silver-ammonia complex ion.—See A., 1942, I, 62.

Reaction between hydrogen and Pyrex glass. L. E. Roberts and C. Bittner (*J. Amer. Chem. Soc.*, 1941, **63**, 1513—1516).—When H_2 is heated with Pyrex glass at an initial pressure of 700 mm. and at 500—580°, the pressure drops steadily owing to diffusion. The rate of pressure drop increases rapidly with temp. Vols. of H_2 required at different temp. to restore the initial pressure and the efficiency of recovery of H_2 after heating in contact with Pyrex have been measured. ~45—75% of H_2 disappeared and ~0·1 of it as H_2O. The glass darkened even below the surface. No equilibrium was attained and it is concluded that the process is an irreversible reaction and that the amount of H_2 removed is sufficiently large to upset pyrolyses in Pyrex in which H_2 is a product. W. R. A.

Ion exchange between solids and solutions. H. F. Walton (*J. Franklin Inst.*, 1941, **232**, 305—337).—Minerals, synthetic inorg. and org. compounds, and colloids which show ionic exchange are enumerated and their structures discussed. The distribution of ions between the exchanger and solution and other physical chemical aspects of the process are also discussed and its applications in H_2O treatment and other uses are enumerated. J. W. S.

Water softening.—See B., 1942, I, 59.

Reactions between acidoids and substances sparingly soluble in water. O. Samuelson (*Svensk Kem. Tidskr.*, 1941, **53**, 60—66).—The reaction between 10 year-old ZnS and an org. sulphonic acid zeolite has been studied. The reagents were ground to <0·01 in. and suspended in H_2O, and the results compared with those obtained with HCl and ZnS. The zeolite liberated H_2S at the same rate as 2N-HCl; it is concluded that the material is a strong acid and that reaction takes place by the action of H^+ in solution on solid ZnS. Similar results were obtained with H bentonite and $CaCO_3$. M. H. M. A.

Electrometric study of precipitation of hydrous indium hydroxide.—See A., 1942, I, 66.

Europium and ytterbium amalgams. H. N. McCoy (*J. Amer. Chem. Soc.*, 1941, **63**, 1622—1624).—Amalgams are formed when $M(OAc)_3$ (M = Eu, Yb) in K citrate is electrolysed between a Hg cathode and Pt anode at low voltage with good current efficiency or by the direct action of K amalgam. The solid amalgams $Hg_{10}Eu$ and Hg_2Eu_3 have been prepared. W. R. A.

Cyanogen halides. P. Kailasam (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 165—169).—Dry Cl_2 has no action on CNI at temp. >40°. Br_2 and dry CNCl interact at room temp., forming a cryst. *compound*, $C_9N_9Cl_8Br$, m.p. 160—161°, subliming at >100°; sol. in Et_2O, CS_2, CCl_4, and light petroleum, very sol. in $CHCl_3$, C_6H_6, and $COMe_2$, insol. in cold, sol. in hot H_2O; decomposed by EtOH and by H_2O at 100—120°, forming cyanuric acid; mol. wt. 206 in C_6H_6. The substance behaves as a mol. compound $2C_3N_3Cl,C_3N_3Br$, dissociating in C_6H_6 solution. Cyanuric chloride interacts with 47% aq. HBr at room temp., forming the *compound* $C_3N_3Cl_2Br$, m.p. 210° with volatilisation; sol. in org. solvents, insol. in cold H_2O, decomposed by EtOH and by H_2O at 120°, giving cyanuric acid. L. J. J.

Geochemical data on Saratoga mineral waters.—See A., 1942, I, 120.

Exchange reaction between gaseous and combined nitrogen. G. G. Joris (*J. Chem. Physics*, 1941, **9**, 775).—No isotope exchange between gaseous $^{15}N_2$ and $^{15}N^{14}N$ and aq. $NaNO_3$, $NaNO_2$, or NH_2OH,HCl could be detected after 360 hr. contact. The results obtained with radioactive N_2 (A., 1941, I, 420) are attributed to difficulties arising in operation with the radioactive isotope. J. W. S.

Formation of [metal] nitrosyls, nitrosocarbonyls, nitrosocyanides, and nitrosohalides. B. Ormont (*Acta Physicochim. U.R.S.S.*, 1940, **16**, 159—175).—The stability and properties of metallic nitrosyl and carbonyl compounds are compared and discussed. It is concluded that the NO mol. donates three electrons to the central atom if by so doing the effective

at. no. of the latter is not increased above the val. for an inert gas, and in these cases the NO compound is more stable than the corresponding CO compound. Otherwise the NO mol. donates only two electrons, and is then less firmly held than CO. F. J. G.

Ammonium salts of aliphatic carboxylic acids. S. Zuffanti (*J. Amer. Chem. Soc.*, 1941, **63**, 3123—3124).—An apparatus for the prep. of anhyd. NH_4 salts of aliphatic carboxylic acids is described. NH_4 salts of the following have been prepared (m.p. in parentheses): $EtCO_2H$ (107°), $Pr^{\alpha}CO_2H$ (108°), $Pr^{\beta}CO_2H$ (118°), $Bu^{\alpha}CO_2H$ (108°), $Bu^{\beta}CO_2H$ (91°), *n*- (108°), and *iso*-hexoic (102°), *n*-heptoic (112°), *n*-octoic (114°), *n*-nonoic (115°). W. R. A.

Sulphur monoxide. E. Kondrateeva and V. Kondrateev (*J. Phys. Chem. Russ.*, 1940, **14**, 1528—1534).—The composition $(SO)_n$ of the gas giving rise to the characteristic absorption spectrum between 3400 and 2500 A. is proved by analysis; *d* agrees with S_2O_2. From the emission spectrum of the real SO its absorption spectrum can be approx. calc.; it is different from that observed. The coeff. of absorption of S_2O_2 is independent of temp. between −70° and 20°, showing that no measurable dissociation to SO takes place. The spectrum of S_2O_2 appears under conditions which make formation of SO energetically impossible. This spectrum cannot be due to S_2 mols. since it is too complicated for a diat. mol. J. J. B.

Mechanism of polymerisation of thiocyanogen from the magnetic viewpoint.—See A., 1942, I, 48.

Dehydration of some pure and mixed chromi-selenic alums and formation of corresponding complex chromi-selenates. P. C. Raychoudhury (*J. Indian Chem. Soc.*, 1941, **18**, 277—280).—$NH_4Cr(SeO_4)_2,12H_2O$ on dehydration at 80—110° yields $(NH_4[Cr(SeO_4)_2],2{\cdot}5H_2O$. $Cr_2(SeO_4)_3,(NH_4)_2SO_4,24H_2O$ yields $(NH_4)_2[Cr_2(SeO_4)_3(SO_4)],3$ (90—105°) and 1·5 (110°)H_2O. $Cr_2(SO_4)_3,(NH_4)_2SeO_4,24H_2O$ yields $(NH_4)_2[Cr_2(SO_4)_3(SeO_4)],4$, 3·5, 3, and 2·5$H_2O$ at 80—100°, 110—120°, 130—150°, and 150—180°, respectively. $NaCr(SeO_4)_2,12H_2O$ yields $Na_2[Cr_2(SeO_4)_4],2$, 1, and 0·5H_2O at 90—100°, 110—120°, and 140—150°. $Cr_2(SO_4)_3,Na_2SeO_4,24H_2O$ yields $Na_2[Cr_2(SO_4)_3(SeO_4)],4$, 3, and 2$H_2O$ at 80—85°, 90—100°, and 120—160°. All these products form green solutions which, when cold and freshly prepared, give no reactions for Cr''', SO_4'', or SeO_4''. They are decomposed when the solutions are heated. F. L. U.

Reactions in mixtures of chromite, magnesia, and alumina.—See B., 1942, **I**, 88.

Formation of ammonium phosphomolybdate in presence of certain organic acids. W. C. Davies (*Analyst*, 1942, **67**, 1—4).—Preformed NH_4 phosphomolybdate is sol. in neutral solutions of citric, oxalic, and malic acids. It is suggested that sol. complexes are formed and that their formation accounts for the interference of certain org. acids with the gravimetric and colorimetric determination of H_3PO_4. Excess of phosphomolybdate and higher temp. tend to reduce the interference. S. B

Ferric thiocyanate. H. I. Schlesinger (*J. Amer. Chem. Soc.*, 1941, **63**, 1765—1767).—Polemical against Bent and French (A., 1941, I, 210). W. R. A.

Complex compounds of diguanide with tervalent metals. VIII, IX.—See A., 1942, II, 78.

Complex compounds of diguanide with bivalent metals. II. Nickel diguanidines. P. Rây and B. C. Purakayastha (*J. Indian Chem. Soc.*, 1941, **18**, 217—224).—The following complex *salts* are described: $RCl_2,2H_2O$; $RBr_2,2H_2O$; RI_2; $RF_2,4H_2O$; $RF_2,HF,(NH_4)HF_2,3{\cdot}5H_2O$; $R(ClO_3)_2,H_2O$; $R(BrO_3)_2,1{\cdot}5H_2O$; $R(IO_3)_2,0{\cdot}5H_2O$; $R_3(IO_5)_2,7{\cdot}5H_2O$; $R(ClO_4)_2$; $R(MnO_4)_2$; $R(BF_4)_2$; $R(NO_3)_2,H_2O$; $R(NO_2)_2,H_2O$; $RSO_4,3H_2O$; $RSO_3,3H_2O$; $RS_2O_3,2H_2O$; $RS_2O_6,2H_2O$; $R(CNS)_2$; $RSeO_4,3H_2O$; $RCrO_4,3H_2O$; $RCO_3,2H_2O$; $R_2Fe(CN)_6,4H_2O$; $R_3[Fe(CN)_6]_2,6H_2O$; $R[Fe(CN)_5(NO)],H_2O$; $R_3[Co(CN)_6]_2,6H_2O$; $R_3[Co(NO_2)_6]_2,18H_2O$; $RHgI_4$; $RI(I_3),1{\cdot}5H_2O$; $RCl(I_3),3H_2O$; R = $Ni(C_2H_7N_5)_2$). The solubility relations and isomorphism of these salts are discussed. F. J. G.

X.—ANALYSIS.

Principles of quantitative spectrochemical analysis. N. S. Bayliss (*J. Proc. Austral. Chem. Inst.*, 1941, **8**, 250—260).—The C or graphite arc, the relation of spectrum intensity to concn., the photographic image, quant. analysis by means of the spectrograph, and errors due to background and stray light are discussed. Spectrochemical analysis is specially suitable for routine work, is widely applicable, and, for concns. of 1 to 0·001%, is often superior to chemical analysis. L. S. T.

Micro-method of chromatographic analysis. M. O'L. Crowe (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 845—846).—The method is suitable for a rapid preliminary selection of solvents, adsorbents, and elutriants. Adsorbents are placed in the cups of a porcelain spot plate and moistened with various solvents. A drop of the solution under investigation is allowed to flow from the rim of the cup into the adsorbent. Larger separations can be effected in Petri dishes. The method is useful in the analysis of small quantities of biological materials. L. S. T.

Karl Fischer reagent. VIII. Determination of water of hydration in salts. W. M. D. Bryant, J. Mitchell, jun., D. M. Smith, and E. C. Ashby. **IX. Reactions with inorganic oxides and related compounds. Oxidation and reduction reactions.** J. Mitchell, jun., D. M. Smith, E. C. Ashby, and W. M. D. Bryant (*J. Amer. Chem. Soc.*, 1941, **63**, 2924—2927, 2927—2930; cf. A., 1941, II, 180).—VIII. The titrimetric determination of H_2O in 25 hydrates which include the hydrated sulphates of the metals extending from Mn to Zn and in the desiccants, activated Al_2O_3, SiO_2 gel, $CaCl_2$, and partly dehydrated $CaSO_4$ ("Drierite"), has been investigated using the Karl Fischer reagent. The titration was rapid and complete except for "Drierite," which gave a low val. attributed to the H_2O being zeolitic in nature.

IX. The nature and stoicheiometry of reactions of the Karl Fischer reagent with inorg. substances other than H_2O, *e.g.*, oxides and salts of the alkali and alkaline-earth metals, have been investigated. Two types of reactions are described, (i) involving the O of metal oxides and salts of oxygen acids and (ii) oxidation and reduction of cations and anions by a modified I_2–I' couple. W. R. A.

[Determination of] fluorine in water.—See B., 1942, III, 39.

Determination of nitrates in water by a modification of the phenoldisulphonic acid method.—See B., 1942, III, 39.

Molybdenum-blue reaction. Spectrophotometric study. J. T. Woods and M. G. Mellon (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 760—764).—The application of the Mo-blue reaction to the colorimetric determination of PO_4''', AsO_4''', and SiO_3'' has been investigated spectrophotometrically. Ranges of the methods, conformity of the blue system to Beer's law, and the effects of variables such as time, temp., acidity, and amounts of reactants on the colour developed have been examined. For PO_4''', the relative merits of H_2SnCl_4, quinol, aminonaphtholsulphonic acid, and a reduced molybdate solution as reductants are compared. The inadequacy of certain proposed permanent standards is shown, and the effects of 63 ions, many of which interfere, are tabulated. L. S. T.

Rapid determination of phosphorus in ferromolybdenum and in calcium molybdate.—See B., 1942, I, 50.

Colorimetric determination of phosphorus in steel and cast iron.—See B., 1942, I, 94.

Use of granulated zinc alloyed with 0·3% of copper for the Gutzeit test for arsenic. G. Taylor and J. H. Hamence (*Analyst*, 1942, **67**, 12—13).—Cu–Zn alloy used in the Gutzeit test (cf. B., 1941, III, 211) does not give a heavier stain on $HgCl_2$ papers than that produced by the ordinary granulated Zn with the same quantity of As. Less erratic results are obtained and there is no need to employ a preliminary reduction with SO_2. $HgBr_2$ papers may be used with the Cu–Zn alloy and give stains which are more intense and more easily assessed than those given with $HgCl_2$ papers. S. B.

"Partition method" for determination of boron [in glass].—See B., 1942, I, 36.

Hydrofluosilicic acid method for determination of quartz. F. H. Goldman (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 789—791).—Procedure for determining the quartz (**I**) content of "settled dusts" is described. Mechanical losses, and losses due to dissolution of (**I**) by the H_2SiF_6 have been reduced greatly by using a const. temp. of 10°, a Munroe crucible

instead of filter-paper, the addition of SiO_2 gel to the H_2SiF_6, and HNO_3 instead of HCl for dissolution of sol. material. L. S. T.

Rapid procedure for determination of carbonate. A. C. Kuyper and L. M. Jones (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 801—802).—The total CO_2 is pptd. quantitatively by adding aq. NaOH followed by aq. $SrCl_2$ to the sample. The reaction mixtures are neutralised (pink to phenolphthalein), a known excess of HCl is added, and CO_2 is removed by aërating, and heating at 80° if necessary. The remaining acid is titrated with alkali. Large amounts of NH_3 interfere with the phenolphthalein end-point, and $Mg^{..}$ interferes in so far as $Mg(OH)_2$ is not redissolved during neutralisation. CO_2-free NaOH is most easily prepared by adding saturated aq. NaOH to slightly acid, boiling distilled H_2O. L. S. T.

[Semimicro-]detection of carbon dioxide and sulphur dioxide from mixtures of carbonates and sulphites. G. B. Heisig and A. Lerner (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 843).—1 mg. of the solid (or neutral solution) is heated with 5 drops of 5N-AcOH for 2 min. in a small test-tube. The evolved gases are passed through a capillary of special shape fixed in the upper half of the tube, and containing acid $Fe[Fe(CN)_6]$, and above this, aq. $Ba(OH)_2$. In presence of 0·005 mg. of SO_3'' the brown solution of $Fe[Fe(CN)_6]$ turns blue in 1 min., and the CO_2 passes on to the $Ba(OH)_2$, which becomes turbid with $\lessdot$0·025 mg. of CO_2. In absence of CO_2, 3 mg. of SO_3'' fail to give a ppt. with the $Ba(OH)_2$. In presence of NO_2', S_2O_3'', and S'', the CO_3'' and SO_3'' must be pptd. first with aq. $Sr(OAc)_2$. L. S. T.

Modified electrometric determination of silver by a dead-stop end-point procedure. R. H. Lambert and R. D. Walker (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 846—848).—The volumetric method described for determining I—10×10^{-9} g.-mol. of Ag makes use of the polarised-electrode method of Foulk and Bawden (A., 1926, 927). Metallic Ag only is determined, and the method is unaffected by $Ag^{.}$. The reactions involved are $2Ag + I_2 \rightarrow 2AgI$ and $I_2 + Na_3AsO_3 + H_2O \rightarrow Na_3AsO_4 + 2HI$. The AgI is dissolved by the 30% KI present during the titration, and the HI neutralised by 0·02N-$NaHCO_3$. Special precautions for reducing the errors involved with such low [Ag] are discussed. 0·0001N. solutions are generally used, but the end-point is still definite and reproducible with 0·00001N. solutions. 5 μg. of Ag can be determined to ±1%, and 0·5 μg. to ±10%. L. S. T.

Determination of radium in some igneous rocks. E. Føyn, E. Gleditsch, and I. T. Rosenqvist (*Amer. J. Sci.*, 1941, **239**, 805—808).—Granitic rocks are disintegrated by heating with NH_4F,HF, and the Rn evolved with the SiF_4 and NH_3 is transferred eventually to the ionisation chamber of an electrometer and its activity measured. The method is rapid and gives results as good as those given by fusion with Na and K carbonates. Gneiss granite from Hol, Drivdalen, and augen gneiss from Rüse, Drivdalen, contain $1·11 \times 10^{-12}$ and $0·77 \times 10^{-12}$ g. Ra per g., respectively. Chemical analyses of these two rocks are recorded. L. S. T.

Fluorescence tests for beryllium and thorium. C. E. White and C. S. Lowe (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 809—810).—1-Amino-4-hydroxyanthraquinone (**I**) gives a red fluorescence (ultra-violet light) with $Be^{..}$ in alkaline solution, and with $Th^{....}$ in acid solution. In ordinary light, the Be solution has the same purple colour as the alkaline solution of (**I**). 1 part of $Be^{..}$ in 10^6 of H_2O can be detected in a dilution of I in 4×10^7. [NaOH] >0·3N. diminishes the fluorescence. $Be^{..}$ can be detected easily in presence of $Al^{...}$ by dissolving the $Be(OH)_2 + Al(OH)_3$ ppt. in NaOH and adding (**I**). $Li^{.}$ $\lessdot$0·007 g. per 10 ml. gives a similar fluorescence. CrO_4'' oxidises the reagent, but moderate concns. of other common ions are without effect. Tartrate decreases the intensity of fluorescence slightly, but nullifies the effect of ions such as PO_4''', AsO_4''', MoO_4'', WO_4'', and uranate, which ppt. $Be^{..}$ in alkaline solution. The $Th^{....}$ solution must be adjusted to p_H ~2 (thymol-blue), and the test is sensitive to 40 μg. of $Th^{....}$ in a dilution of 1 to 250,000. $Ce^{....}$, $Au^{...}$, and ions of the Pt metals destroy the reagent, and many anions interfere. L. S. T.

Polarographic analysis. W. C. Davies (*Chem. and Ind.*, 1941, 883—884).—A criticism (cf. B., 1941, **I**, 557). Complete chemical separation of an element before polarographing is not always essential. The essence of inorg. polarographic analysis is avoidance by the use of proper ground solutions of as many chemical separations as possible. L. S. T.

Polarographic analysis. A. C. Coates and R. Smart (*Chem. and Ind.*, 1942, 41—42).—A reply to criticism (cf. preceding abstract). 0·01—0·5% of Zn in Al or its alloys can be determined polarographically with a speed and accuracy unobtainable by other methods. The presence of Fe as a major impurity in Al renders the determination of the minor impurities inaccurate unless preliminary separations are made. In the polarographic analysis of metals, chemical separations, which can be relatively crude, are usually necessary when max. accuracy is required. L. S. T.

Spectrochemical analysis of trace elements in [mixed] fertilisers. Zinc.—See B., 1942, III, 5.

Simultaneous determination of zinc and sulphur in zinc sulphide concentrates by combustion of sulphur in oxygen.—See B., 1942, **I**, 52.

Rapid method for the micro-analysis of lead. L. T. Fairhall and R. G. Keenan (*J. Amer. Chem. Soc.*, 1941, **63**, 3076—3079).—The content of Pb in normal urine as determined by dithizone is > that measured by chemical separation. A rapid micro-method for the determination of Pb is described. Aq. NH_3 is added to urine in a glass-stoppered mixing cylinder until the froth is coloured blue with thymolphthalein indicator (p_H 10) and the ppt. is allowed to settle, collected, and dissolved in dil. HNO_3. The solution is boiled gently; 30 c.c. of 50% citric acid are added and the solution is neutralised by aq. NH_3. The solution is extracted with a solution of dithizone in $CHCl_3$ (100 mg. per l.), and washed three times with H_2O to remove citric acid. The Pb is removed from the $CHCl_3$ layer by 10 c.c. of 2% HNO_3 and pptd. as $PbCrO_4$, boiled, filtered, dissolved in a few drops of HCl, and washed into a 5-c.c. glass-stoppered flask. KI is added and the solution titrated with 0·002N-$Na_2S_2O_3$ using CS_2 to indicate the end-point. The procedure may be used for the determination of Pb in drinking water. W. R. A.

Separation and determination of lead with salicylaldoxime. W. B. Ligett and L. P. Biefeld (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 813—815).—Pptn. of $Pb^{..}$ from nitrate solution by means of salicylaldoxime (**I**) commences at p_H ~4·8, and is complete at p_H 6·9, but in order to obtain a compound to which the theoretical factor of 0·6053 for $PbC_7H_5O_3N$ (**II**) can be applied, pptn. must be carried out at p_H $\lessdot$8·9. The ppt. can then be dried at 105° for 1 hr. before weighing. $Pb^{..}$ can be separated as the (**I**) compound from $Ag^{.}$, $Cd^{..}$, and $Zn^{..}$, but not $Cu^{..}$, $Ni^{..}$, $Co^{..}$, $Bi^{...}$, $Fe^{...}$, $Mg^{..}$, $Mn^{..}$, and $Hg^{..}$, in strongly ammoniacal solution. 0·05M-OAc′ increases the p_H necessary for commencement of pptn., completeness of pptn., and complete pptn. as (**II**), by ~0·5 unit. L. S. T.

Use of titanous chloride in determination of lead in lead salts and in certain metal-copper alloys.—See B., 1942, **1**, 84.

Absorption spectrum as a quantitative test for mercury vapour in air. K. C. Clark and O. Oldenburg (*J. Chem. Physics*, 1941, **9**, 786—788).—Hg vapour at v.p. $\ll$ the toxic limit can be determined by comparing the spectrum of a suspected or contaminated atm. with standard calibration spectra. W. R. A.

Separation and determination of mercury, bismuth, and zinc in "skin bleaches."—See B., 1942, III, 36.

Europium and ytterbium in rare earth mixtures. Polarographic determination. H. A. Laitinen and W. A. Taebel (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 825—829).—Current–voltage curves for Eu and Yb in 0·1N-NH_4Cl are recorded and discussed, and applied to the polarographic determination of these elements. In 0·1N-NH_4Cl, the half-wave potentials of Eu and Yb, referred to the saturated Hg_2Cl_2 electrode, are −0·671 and −1·415 v., respectively. The polarographic method described for Eu gives results agreeing to within 3% with those obtained by means of the Jones reductor. Conditions favouring the polarographic determination of Yb are discussed, and satisfactory results have been obtained with ores containing ~5% Yb. In the simultaneous determination of Eu and Yb, correction must be made for the effect of decreasing drop time with an increase in negative potential. L. S. T.

Fluorescence method for [determining] aluminium. C. E. White and C. S. Lowe (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 810).—The test described previously (A., 1937, I, 580 is

improved by dissolving the Pontachrome Blue Black R in 95% EtOH, and by heating the test solution to ~80° before adding the reagent. L. S. T.

Analysis of aluminium and its alloys.—See B., 1942, I, 98.

Detection of gallium by a fluorescence reaction with 8-hydroxyquinoline. E. B. Sandell (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 844—845).—Ga can be detected by adding 8-hydroxyquinoline to a solution having p_H 2·6—3, and shaking with $CHCl_3$. In presence of Ga, the $CHCl_3$ layer gives, in ultraviolet light, a yellowish fluorescence tinged with green. In reacts slightly at p_H 3, but not at p_H 2·6, whilst Li, Be, and Sc, in relatively large amounts, give faint fluorescences. $Fe^{'''}$ and $VO_3^{'''}$ must be reduced by means of NH_2OH,HCl; $Cu^{''}$ pptd. as CuCNS, and $MoO_4^{''}$ as $PbMoO_4$ with $Pb(NO_3)_2$. Sn, Sb, Bi, Ti, Nb, Ta, and Te also are best removed before testing for Ga. $Zn^{''}$ and F' reduce sensitivity, and citrate inhibits the reaction. Most other ions have no effect. At p_H 3·0, 0·1 μg. of Ga in 5—10 ml. of solution is detectable. Sensitivity is > this at p_H 4, and < this at p_H 2·6. Details of procedure are given. L. S. T.

Auto-radiography of ores. C. Goodman and D. C. Picton (*Physical Rev.*, 1941, [ii], **60**, 688).—Lapped surfaces of Mn minerals, after activation by slow neutrons, were placed in contact with photographic film. The relative brightness of the prints prepared from the auto-radiographs gives a qual. indication of the content and uniformity of distribution of Mn in the ores. N. M. B.

Analysis of manganese minerals.—See B., 1942, I, 53.

Analysis of iron and manganese minerals and determination of phosphorus, aluminium, and titanic acid.—See B., 1942, I, 45.

Determination of ferrous iron in resistant silicates. M. H. Hey (*Min. Mag.*, 1941, **26**, 116—118).—Rowledge's method of fusion with $2NaF + B_2O_3$ in a sealed glass tube (B., 1935, 949) is adapted on a micro-scale (10 mg.). The fusion cake is dissolved in ICl solution in HCl, and the liberated I titrated with KIO_3. L. J. S.

Silver reductor in analytical chemistry. E. E. Halls (*Ind. Chem.*, 1941, **17**, 230).—The merits of the Ag reductor–$Ce(SO_4)_2$ method for Fe are compared with those of the $Ti_2(SO_4)_3$ method. A. R. P.

Micro-analytical testing of iron and steel.—See B., 1942, I, 47.

Spectrographic analysis of tin-lead solders.—See B., 1942, I, 53.

Rapid colorimetric determination of zirconium in steel.—See B., 1942, I, 50.

Assaying cyanide solutions for gold.—See B., 1942, I, 97.

Colorimetric detection and determination of palladium with compounds containing the *p*-nitrosoanilino-group. L. G. Overholser and J. H. Yoe (*J. Amer. Chem. Soc.*, 1941, **63**, 3224—3229).—Compounds containing the $p\text{-}NO\cdot C_6H_4\cdot N<$ group form highly-coloured complexes with Pd^{II} salts similar to that formed with $NHPh\cdot C_6H_4\cdot NO\text{-}p$. Complexes of $PdCl_2$ and $Pd(NO_3)_2$ with the following have been prepared and have the general formula $Pd[NO\cdot C_6H_4\cdot NX_2]Y_2$: *p*-nitroso-aniline, -dimethyl- (**I**) and -diethyl-aniline (**II**). They can be used for the detection of small amounts of Pd^{II} ions. (**I**) and (**II**) are better colorimetric reagents because they have (*a*) faster reaction rate, (*b*) greater stability, and (*c*) smaller temp. effect, and (*d*) are more suitable for spectrophotometric studies. Absorption curves for reagents and complexes are given and discussed. A procedure is given for the colorimetric determination of Pd in presence of Ag. W. R. A.

XI.—APPARATUS ETC.

Adjustable vapour thermoregulator. J. Y. Yee (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 839).—The Et_2O vapour thermoregulator described operates to ±0·02° between 20° and 40°. L. S. T.

Thermostats employing external surface control. V. D. Hopper (*Proc. Physical Soc.*, 1942, **54**, 55—62).—The principles involved in the production of const. temp. are discussed. They have been applied to the design of thermostats using an external resistance thermometer to control the heat supply, which may be radiant heat or heated air. Sensitivity is > 0·01°. N. M. B.

Measurement of flame temperatures.—See B., 1942, I, 21.

Method of installing tube-wall thermocouples. E. L. Patton and R. A. Feagan, jun. (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 823—824).—The method described can be used to locate a thermocouple junction at any point in the wall of the tube, and to carry the leads to any desired point through a substantially isothermal zone. L. S. T.

Modified calorimeter for high temperatures. Heat content of silica, wollastonite, and thorium dioxide above 25°. J. C. Southard (*J. Amer. Chem. Soc.*, 1941, **63**, 3142—3146).—A calorimeter for high-temp. sp. heats is described. The vals. of *H* above room temp. have been measured for wollastonite (up to 1433° K.), ThO_2 (up to 1780° K.), and SiO_2 glass (up to 1522° K.). Equations for the data have been constructed and hence vals. of C_p have been derived. W. R. A.

Simple refraetometer. F. Benford (*J. Opt. Soc. Amer.*, 1939, **29**, 352—354).—A brass plate carrying a prism-shaped holder for the glass being tested is mounted on the table of a comparator used for measurement of λ in spectrum plates. The holder has a polished mirror vertical face and a polished face at an angle of 45°. The thickness of the plane-parallel glass plate and the apparent displacement of an object viewed through it are measured, and *n* is read from a curve. The average error is ±0·006. A. A. E.

Counting of particles in the slit ultramicroscope. O. Spengler and H. Hirschmüller (*Kolloid-Z.*, 1941, **94**, 29—30).—As a substitute for the short-lived high-pressure Hg lamp a C arc can be used to illuminate the slit for photographic exposures of 0·05 sec. if thin (~5 mm. diameter) electrodes are used and loaded with 100—120 amp.; the brightness of this source is approx. equal to that of the sun. Exposures are made on 16-mm. cine-film at the rate of 16 per sec. An automatic interruptor for visual counting is described. F. L. U.

Film-contraction errors in lattice-spacing measurements. W. Hume-Rothery, G. V. Raynor, and A. T. Little (*J. Sci. Instr.*, 1941, **18**, 239—240).—The assumption that a film expands and contracts uniformly during development and drying, and that no changes in length occur during exposure, is discussed. Changes which occur during exposure and drying are described. Films are preferably kept under conditions of const. temp. and humidity, and a current of filtered air of approx. the same humidity is passed through the camera before and during exposure. A. A. E.

Supersonic cell fluorometer. H. B. Briggs (*J. Opt. Soc. Amer.*, 1941, **31**, 543—549).—A method by means of which luminescence changes excited in phosphors by cathode-ray beams and extending over periods of a few μ-sec. is measured is described. A rectangular voltage-wave of known frequency is used to produce simultaneous excitation of the phosphor and a pulse of high-frequency supersonic waves from a quartz crystal. By varying the distance travelled through a liquid by the pulse before passing through a collimated light beam from the phosphor, it is arranged that a known time interval elapses between the luminescence change and the formation of a Debye–Sears diffraction pattern which is received by a photo-electric cell. L. J. J.

Photographing sugar and other crystals. W. V. Morton (*News Edn. Amer. Chem. Soc.*, 1941, **19**, 1194).—An inverted camera for photographing crystals under oblique illumination is described with reference to a sketch. The crystals are placed at the bottom of a glass cylinder in a non-aq. liquid, *e.g.*, glycerol, saturated with sugar and the illumination is provided by four 40-w. lamps regularly disposed around the cylinder. The lens of the camera is placed below the cylinder and a ground-glass film plane with viewing mirror below is provided at the bottom of the plywood camera body carrying the whole of the apparatus. A. R. P.

Lundegårdh apparatus [for spectrographic analysis of solutions]: its construction and use. J. A. C. McClelland and H. K. Whalley (*J.S.C.I.*, 1941, **60**, 288—291).—A detailed description is given of the Lundegårdh apparatus in which the solution to be analysed is sprayed into a flame, and the light from the flame analysed by means of a quartz spectrograph. The use of the apparatus is described, and data on

the accuracy and sensitivity are given. Some analyses for which the method is regularly used are briefly described. C. E. H.

Absorption spectrum as a quantitative test for mercury vapour in air.—See A., 1942, I, 114.

Photon counters for spectral investigations in the ultra-violet.—See A., 1942, I, 2.

Photometry in spectrochemical analysis. W. C. Pierce and N. H. Nachtrieb (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 774—781).—Methods for plate calibration, variations in plate gamma with λ, the effect of background and methods for its correction, accuracy obtained in photometric measurements of intensity ratios, and working curves and the factors governing the selection of an internal standard are discussed. Graphical computation methods are described. Criteria for evaluation of a photometer are given, and the construction of a satisfactory instrument is described. L. S. T.

Spectrographic analysis of briquetted tablets. H. W. Dietert (*J. Opt. Soc. Amer.*, 1941, **31**, 693—696).—Electrical excitation of specimens for spectrographic analysis is facilitated by pressing the specimen, mixed with a good electrical conductor such as sucrose, C, or metals, and in some cases with a binder such as sucrose, into firm tablets. An element, *e.g.*, Fe, may be added as an internal standard. Details of briquetting and spectrographic procedure are given. L. J. J.

Quartz photo-electric spectrophotometer. H. H. Cary and A. O. Beckman (*J. Opt. Soc. Amer.*, 1941, **31**, 682—689).—The photo-electric spectrophotometer described, for measurements in the ultra-violet and visible regions, incorporates a mirror-collimated quartz prism monochromator on the principle of the Littrow spectrograph, photo-cell with electronic amplifier, and direct-reading potentiometer. Performance data are recorded. L. J. J.

Automatic recorder of spectral sensitivity of photo-electric surfaces. J. T. Tykociner and L. R. Bloom (*J. Opt. Soc. Amer.*, 1941, **31**, 689—692).—The method described employs a Hardy spectrophotometer with two glow discharge lamps, modulated at 60 cycles, one of which is controlled photo-electrically so that its light intensity $\propto$ the relative spectral sensitivity of the photo-electrical surface investigated. The other lamp serves as a light intensity reference source, and its intensity is controlled mechanically. A detector photo-tube, controlling the recording mechanism by means of thyratrons, receives the light emitted by both lamps. L. J. J.

Raman effect. CXVI. New crystal powder apparatus.—See A., 1942, I, 83.

Magnetic device for control of the arc in spectrochemical analysis. R. Taylor (*J. Sci. Instr.*, 1942, **19**, 11).—The position of the arc is stabilised by rotating the lower electrode (25 r.p.m.) and deflecting the arc magnetically to its near edge. A. A. E.

Mass spectrometer for isotope analysis. H. S. Brown, J. J. Mitchell, and R. D. Fowler (*Rev. Sci. Instr.*, 1941, **12**, 556; cf. A., 1941, I, 485).—Corrigenda. D. F. R.

Calculation of the error due to the absence of guard electrodes in *X*-ray ionisation chambers. N. L. Walbridge (*Rev. Sci. Instr.*, 1941, **12**, 546—548).—An equation is given expressing the fraction of the incident *X*-ray power which escapes as kinetic energy of electrons; it can be used to eliminate the necessity of guard electrodes. D. F. R.

Electrostatic generator for nuclear research at the Massachusetts Institute of Technology. L. C. Van Atta, D. L. Northrup, R. J. Van de Graaff, and C. M. Van Atta (*Rev. Sci. Instr.*, 1941, **12**, 534—545).—The construction of the generator and of the high-voltage accelerating tube mounted vertically in one of the columns is described. Currents up to 4×10^{-3} amp. and voltages up to $2{\cdot}7 \times 10^6$ v. may be obtained. An account is given of experience with the acceleration of positive ion and electron beams and with the *X*-ray bombardment of In, Be, and D. Yield curves, showing the variation of initial counting rate with voltage of 5-min. bombardments; are given for Be and D. D. F. R.

Continuous-reading electronic voltmeter for use with glass and other high-resistance electrode systems. C. J. Penther, F. B. Rolfson, and L. Lykken (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 831—834).—The meter described has a range of $\pm 2{\cdot}11$ v., and a sensitivity of $\pm 0{\cdot}001$ v. It is designed for the accurate determination of potentials of electrode systems that have a resistance of ≥ 5000 MΩ. L. S. T.

Constant mercury level for the dropping mercury electrode. A. Langer (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 794).—A floating bulb valve device is described. L. S. T.

Pyrex all-glass micro-electrophoresis cell. D. R. Briggs (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 703—705).—A cell and electrical circuit for measuring the migration velocities of particles suspended in org. or aq. liquids is described. L. S. T.

Platinised porous graphite as a hydrogen electrode.—See A., 1942, I, 64.

Silicon carbide electrode.—See A., 1942, I, 65.

Treatment of platinum electrodes used for determining the redox potential of soil.—See B., 1942, III, 3.

Absolute measurement of electrical resistance by a method using the average electromotive force of a commutating generator. H. R. Nettleton and E. G. Balls (*Proc. Physical Soc.*, 1942, **54**, 27—46; cf. A., 1940, I, 41).—The e.m.f. across the resistance (~1 Ω.) when conveying d.c. is balanced against the average e.m.f. of a commutating generator, the field coils of which convey the same current. The method allows the two main errors associated with break and self-inductance to be set against one another. N. M. B.

Semi-conductor photocells and rectifiers.—See B., 1942, I, 61.

Rectifiers.—See B., 1942, I, 6.

Signer method for determining mol. wts. E. P. Clark (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 820—821).—Apparatus and procedure for determining mol. wts. by Signer's isothermal distillation method (A., 1930, 531) are described. Azobenzene furnishes a good standard where org. solvents are used. Typical mol. wts. for certain org. compounds are recorded. L. S. T.

Determination of molecular and ionic weights of dissolved substances by the methods of dialysis and free diffusion. III. G. Jander and H. Spandau (*Z. physikal. Chem.*, 1941, **A, 188**, 65—89).—A reply to Brintzinger (*ibid.*, 1940, **187**, 317). F. J. G.

[Apparatus for determining] densities of molten rocks and minerals.—See A., 1942, I, 123.

Attempted isotopic separation by fractional crystallisation. W. J. C. Orr (*Trans. Faraday Soc.*, 1941, **37**, 587—590).—A continuous counter-flow arrangement to deal with a cryst. phase and its saturated solution is described. No detectable separation of Cl isotopes was observed when the apparatus was operated continuously for 1 month with NaCl. F. L. U.

Laboratory-size continuous distillation unit. R. W. Hufferd and H. A. Krantz (*Ind. Eng. Chem.*, 1941, **33**, 1455—1459).—A detailed description of the unit, which consists of an air-pressure feed system, a single column packed with Ni helices, a reboiler, a splash chamber, a total condenser with overhead product take-off, and the usual heating (electric) and cooling arrangements, is given. The efficiency corresponds with 52—56 theoretical plates. The unit can cope with a throughput of one quart per hr. at a reflux rate of 3 : 1. C. R. H.

Analytical separation of sugars by distillation of their propionates.—See A., 1942, II, 79.

Distillation of sugar propionates at low pressure.—See A., 1942, II, 79.

Action of light on cellulose. VI. Measurement of the osmotic pressure of colloidal solutions. R. E. Montonna and L. T. Jilk (*J. Physical Chem.*, 1941, **45**, 1374—1381).—An apparatus for measuring with <5% error the osmotic pressure of colloidal solutions using a denitrated collodion membrane is described. Data obtained with $COMe_2$ solutions of cellulose nitrate illustrate the application of the method. C. R. H.

Laboratory agitator. G. H. Botham (*Chem. and Ind.*, 1942, 10—11).—A simple mechanical agitator, suitable for use in a m.p. apparatus and working on slight suction or compression, is described. H. G. R.

Small-scale centrifuge accessories for use with corrosive materials. G. F. Smith (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 824).—Porcelain centrifuge cups with perforated bases are described. I lb. of crystals of average ρ can be centrifuged at 2000 r.p.m. and 10 lb. can be filtered, centrifuged, and washed in 1 hr. by means of the equipment described. L. S. T.

Controlling apparatus to eliminate waste of water in using the ordinary filter pump. F. E. Holmes (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 759—760).—A closed suction system with automatic control of the supply of H_2O to the aspirator is described. It is trustworthy, and operates continuously with little or no attention. L. S. T.

Stability of the permanganate–periodate colour system. J. P. Mehlig (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 819).—The exceptional stability of this colour system is re-emphasised (cf. A., 1939, I, 431). L. S. T.

Nitric and sulphuric acids, a colourless cleaning mixture for glassware. W. C. Tobie (*J. Lab. clin. Med.*, 1941, **26**, 1797—1798).—A 9 : 1 (vol.) mixture of conc. H_2SO_4 and HNO_3 is recommended. C. J. C. B.

Modified Jones reductor. J. E. Edwards (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 673).—The apparatus described permits reduction of warm solutions. The exit tube of a Jones reductor is connected by means of a 3-way tap and vertical glass tubing to the tap of a coil surrounded by cooling H_2O. The reduced solution is collected in a beaker contained in a Witt filtering apparatus. L. S. T.

Capillary flowmeter. H. N. Alyea (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 686).—The all-glass instrument described measures continuously the rate of flow of a liquid (a few ml. per hr.) immediately before it is vaporised in a catalyst chamber. It is insensitive to momentary fluctuations in room temp. L. S. T.

Laboratory-scale flow regulator. V. H. Cheldelin and B. E. Christensen (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 805).—Apparatus for regulating the slow flow of gases is described. L. S. T.

Portable low-pressure gas tanks. G. R. Robertson (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 686).—The tank described is suitable for distributing from a central supply 10—200 l. of O_2 for combustions, N_2 for experiments requiring an inert atm., and gaseous mixtures of special composition. L. S. T.

Precision feed device for catalytic experiments. R. L. Burwell, jun. (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 681—682).—In the apparatus described Hg is displaced by the gas evolved by the electrolysis of 30% aq. KOH. The displaced Hg forces the feed liquid into a pre-heater. The feed rate can be set or changed quickly to a predetermined val., and the apparatus can be used at pressures from 1 atm. to ~50 mm. L. S. T.

Micro-hydrogenation apparatus. A. N. Prater and A. J. Haagen-Smit (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 705—707).—In the apparatus described the reaction and measuring system is shaken as a unit, thus eliminating ground joints which must be able to rotate freely and yet remain gas-tight. Data for cinnamic and maleic acids with PtO_2 as catalyst and glacial AcOH as solvent illustrate the trustworthiness of the apparatus. L. S. T.

Generator for production of pure carbon dioxide. W. H. Rauscher (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 694—695).—An improved modification of the Poth type of generator is described. L. S. T.

Removal of static charges from glassware by ultra-violet light. C. J. Rodden (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 693).—Charges produced on glassware after wiping with chamois leather are dissipated readily by exposure for 10 min. to the light from a Hanovia Alpine sun lamp or General Electric Lab-Arc 60 cm. distant. L. S. T.

High-vacuum valve. D. B. Cowie and G. K. Green (*Rev. Sci. Instr.*, 1941, **12**, 556).—A high-vac. modification of the ordinary steam valve is described. D. F. R.

Apparatus for sampling and testing explosion gases from blasting.—See B., 1942, I, 104.

[Apparatus for determining] rate of formation of nuclei in supersaturated solutions.—See A., 1942, I, 16.

Durability of glass containers.—See B., 1942, I, 37.

Nomograph for the solubility of sulphur dioxide in water.—See A., 1942, I, 54.

Nomographs for the solubilities of hydrogen and nitrogen in liquid ammonia.—See A., 1942, I, 54.

XIII.—GEOCHEMISTRY.

Temperature of the ionosphere.—See A., 1942, I, 3.

Optics of atmospheric haze.—See A., 1942, I, 44.

Fluctuations of atmospheric sulphur dioxide. W. J. Youden (*Contr. Boyce Thompson Inst.*, 1941, **11**, 473—484).—Daily, weekly, and annual cycles in the atm. [SO_2] are established by means of continuous records. Data are discussed in relation to weather conditions. A. G. P.

Experiments on condensation nuclei. P. J. Nolan (*Proc. Roy. Irish Acad.*, 1941, **47**, **A**, 25—38).—The initial val. of the ratio of concn. of total nuclei to concn. of uncharged nuclei, Z/N_0, is independent of humidity and concn., but increases on storage from 1·9 to a final val., attained in 7—17 hr., of 2·5—3·5, depending on the initial concn. of the nuclei. The decay of atm. nuclei in a closed vessel follows the equation $dZ/dt = -\gamma Z^2 - \lambda Z$, the val. of γ agreeing with that of Kennedy's flame nuclei. The exponential loss is mainly due to diffusion taking place in a boundary layer of thickness $\propto$ (linear dimensions of vessel)$^{\frac{1}{2}}$. D. F. R.

Analysis of mineral water at Kinkei in Totigi province. K. Kuroda (*Bull. Chem. Soc. Japan*, 1941, **16**, 234—237).—Spectroscopical and chemical examination has indicated the presence of 24 elements. The principal constituents are H_2SO_4, $FeSO_4$, $Al_2(SO_4)_3$, and H_2SiO_3. The H_2O, which has p_H 2·4, contains ~0·05 Mache unit of Rn per l. C. R. H.

Mineral spring at Surangudi, Tinnivelly District, South India. T. N. Muthuswami (*Quart. J. Geol. Soc. India*, 1941, **13**, 95—101).—A more detailed account of work already noted (A., 1941, I, 308).

Ansh-Bulat mirabilite lake. A. V. Zdanovski and D. I. Riabtschikov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 363—375).—Analytical data are recorded. The brine is of the sulphate type. During the winter months mirabilite is deposited in very large amount from the lake H_2O. Methods of utilising the residual brine for prep. of $MgCl_2$ and bromides are discussed. R. T.

Geochemical data on Saratoga mineral waters, applied in deducing a new theory of their origin. L. W. Strock (*Amer. J. Sci.*, 1941, **239**, 857—898).—Spectrochemical determinations of Zr, Sn, Be, Ti, V, Mn, and Ni in Saratoga H_2O show that Zr, Sn, and Be are enriched considerably compared with their average amounts in the lithosphere, whilst the other elements are depleted. The ratio Zr : Ti is > in the earth's crust by a factor 4700. The geochemical process responsible for this characteristic trace element distribution involves dissolution of Zr and Ti from their minerals by $Ca(HCO_3)_2$ solutions containing an excess of CO_2, and the formation of $ZrO(CO_3)_2''$, which is stable and sol. in aq. $Ca(HCO_3)_2$. The corresponding Ti ion is not stable under the same conditions, and the Ti is pptd. near its source and thus separated completely from the Zr by the mineral waters. Sn and Be are enriched by this process. Aq. $Ca(HCO_3)_2$ dissolves much Zr from pptd. ZrO_2 and from eudialite. Deposition of travertine from the Orenda spring shows that Ca is deposited from the waters much earlier than Mg and Zr. An attempt to trace the origin of the more abundant constituents in Saratoga H_2O to known geological formations of the region has been made, and a theory of origin that accounts for the amounts and ratios of the characteristic constituents is presented. L. S. T.

Distribution and types of coliform bacteria in lakes and streams.—See A., 1942, III, 269.

Radioactivity of ocean sediments. IV. Radium content of sediments of the Cayman Trough [between Cuba and Jamaica]. V. Concentrations of the radioelements and their significance in Red Clay. W. D. Urry and C. S. Piggot (*Amer. J. Sci.*, 1942, **240**, 1—12, 93—103; cf. A., 1941, I, 134).—IV. The Ra contents of ocean-bottom cores from this trough are tabulated and discussed.

The radio-elements are not in equilibrium in the uppermost layers of the sediments at the bottom of the ocean. A history of U, Io, and Ra is reflected in the variation of the Ra content of ocean sediments with the depth below the ocean floor. Measurements of this variation show that the [U], [Io], and [Ra] at any given time are established by the usual growth and decay laws of radioactivity in a system that is not in radioactive equilibrium.

V. The relationship between U, Io, and Ra in the deep-sea deposits known as Red Clay is similar to that described previously for calcareous sediments of the ocean. The Red clay (246 cm. core) differs from the sediments by a very rapid decrease in the Ra content ($10{\cdot}79 \pm 0{\cdot}13 \times 10^{-12}$ g. per g.) just below the surface of the ocean bottom, and the attainment of the final equilibrium between U, Io, and Ra in the bottom quarter of the core, which indicates a slow deposition compared with that of the calcareous deposits. The Ra content at equilibrium with the U is only 7% of that near the surface of the deposit. The high surface concns. of Ra and Io are only transient phenomena produced by an unknown mechanism that concentrates these elements, relative to U, during deposition. L. S. T.

Witsand meteorite, South-West Africa. S. J. Shand (*Amer. J. Sci.*, 1942, **240**, 67—71).—The stone belongs to the class of "friable white chondrites." In addition to metallic Fe and some Ni-Fe, only olivine and hypersthene have been recognised. L. S. T.

Luminescence of meteorites. J. D. Buddhue (*Amer. J. Sci.*, 1941, **239**, 839—844).—Certain meteorites luminesce to different extents when exposed to an electric discharge in a vac., but not in *X*-rays or ultra-violet light. Enstatite is the most active mineral, but not all of it is active. Olivine is not active. The usual colour of the glow is bluish, but two howardites give a yellow glow, and two other stones a red luminescence. Roasting of the Holbrook, Arizona, meteorite in air changed the glow from blue to green. Inactive meteorites are all dark brown or black, whilst the most active are light in colour. L. S. T.

Thermal state of the earth. H. Jeffreys (*Amer. J. Sci.*, 1941, **239**, 825—835).—A review of data related to the internal heat of the earth indicates that (i) the average radioactivities of surface rocks show a steady decrease with increase of ρ, although there is much scatter within a given type, (ii) heat generated at depths up to ~300 km. has had sufficient time to be conducted out as rapidly as it is produced, (iii) fusion temp. are not a normal feature at any depth within the crust, and (iv) the thermal contraction available for mountain formation remains essentially unchanged. L. S. T.

Distribution of helium and radioactivity in rocks. II. Mineral separates from the Cape Ann granite. N. B. Keevil (*Amer. J. Sci.*, 1942, **240**, 13—21; cf. A., 1939, I, 106).—Data obtained by the He age method are recorded for the Essex Co. granite at Cape Ann, Mass., and its common mineral constituents. The granite is more radioactive than usual, probably owing to active accessories associated with the femic minerals. Relative radioactivities of the femics, quartz, and felspar are ~23 : 2 : 1. In spite of the relatively high rate of He production, the femics gave the highest He index, 189. The quartz (94) and felspar (59) showed evidence of losing He during geological time and after exposure at the surface. Further experiments on minerals are required before He index can be used in geological correlation. L. S. T.

Alteration of radioactive minerals. T. C. Sarkar (*Proc. Indian Acad. Sci.*, 1941, **14**, **B**, 261—270).—Four possible methods of alteration of radioactive minerals by solutions are discussed in explanation of the discordant Pb ratios of U and Th minerals. The most important of these is that Pb in radioactive minerals is present partly as plumbate and U partly as uranate, and that SiO_2 as silicate in percolating waters may displace plumbate and uranate ions. Age indications given by slightly-altered monazites may be trustworthy. No common Pb is present in radioactive minerals derived from pegmatites. L. S. T.

Ore deposits of Captain's Flat, New South Wales. E. S. Kenny and C. St. J. Mulholland (*Proc. Austral. Inst. Min. Met.*, 1941, No. 122, 45—62).—The geology of the country surrounding Captain's Flat in the Federal Territory near Canberra, N.S.W., is described in detail. The ore consists of galena, blende, and Cu pyrites in a gangue of quartz-sericite schist (altered porphyry) and is estimated to exceed 2,000,000 tons assaying Pb 7·9, Zn 13·11, Cu 0·7%; Au 1·2, Ag 48 dwt. per ton. A. R. P.

Some tantalum–niobium minerals from W. Australia. A. B. Edwards (*Proc. Austral. Inst. Min. Met.*, 1940, No. 120, 731—744).—Tantalorutile (**I**) from Globe Hill, W. Australia, is a greyish-brown, anisotropic, homogeneous mineral, d 4·83, containing TiO_2 66·28, Ta_2O_5 15·44, Nb_2O_5 8·64, FeO 8·00, SnO_2 1·24, SiO_2 0·32, H_2O 0·18%. Analysis of a specimen from Melville showed TiO_2 43·2, Nb_2O_5 33·3, Ta_2O_5 7·6, FeO 10·8, MnO 3·6, SnO_2 0·4, SiO_2 0·6, H_2O 0·16%, d 4·9; microscopic examination of etched polished specimens showed it to consist of finely intergrown crystals of mossite, rutile, and ilmenite. It is suggested that the Melville specimen is the result of unmixing of a solid solution of (**I**). Polished sections of ferrotantalite from Greenbushes showed no cassiterite (**II**), although the specimen contained 1·5% of SnO_2; the SnO_2 therefore appears to be in solid solution, as also does the 1·76% of Ta_2O_5 found in some specimens of (**II**) from the same locality. W. Australian ainalite, however, consists of crystals of (**II**) separated by crystals of a Ta_2O_5-rich mineral. Analyses are given of three specimens of stibiotantalite. A. R. P.

Coated gold from Cobar, New South Wales. F. L. Stillwell and A. B. Edwards (*Proc. Austral. Inst. Min. Met.*, 1941, No. 121, 1—10).—Table concentrates obtained from the New Cobar mine contain a large no. of particles of "black Au"; this consists of native Au particles coated with native Bi (**I**), galena, galenobismutite (**II**), or maldonite (Au_2Bi), or with dark AgCl. Many of the particles of (**I**) and (**II**), which are also present in the concentrate, contain inclusions of Au, generally between crystal boundaries or in small cavities. A. R. P.

Mineral composition of the Mount Oxide copper ore, Queensland. A. B. Edwards (*Proc. Austral. Inst. Min. Met.*, 1940, No. 118, 83—95).—The ore consists essentially of chalcocite (**I**) with minor amounts of pyrite; in the more oxidised parts the (**I**) is replaced by cuprite, tenorite, malachite, brochantite, and occasionally by azurite. The (**I**) appears to be of supergene origin, and its Cu content is probably derived from primary Cu sulphide minerals that once existed in the higher levels of the ore-body; the Cu dissolved from these latter was repptd. on the pyrite which existed in the lower zone, and the resulting (**I**) was then slowly oxidised locally to give the oxidised Cu minerals mentioned above. A. R. P.

Barytes deposit at Pembroke, Hants County, Nova Scotia. A. E. Cameron (*Proc. Nova Scotian Inst. Sci.*, 1940—41, **20**, 57—63).—The deposit described consists of $>10^6$ tons of high-grade, light red barytes in Palæozoic sediments. It appears to be a replacement deposit formed by descending supergene solutions percolating down through an Fe-rich calcareous series of sediments, and replacing the CaO-rich portions by $BaSO_4$. The analysis is $BaSO_4$ 97·1, CaO 0·1, Fe_2O_3 0·8, and SiO_2 1·1%. L. S. T.

A crystal of augelite from California. M. A. Peacock and D. A. Moddle (*Min. Mag.*, 1941, **26**, 105—115).—A detailed crystallographic description is given of a large (15 × 8 × 6 mm.) crystal of gem quality from White Mountain, Mono County (A., 1936, 50). Several new crystal-forms are referred to the axial ratio $a : b : c = 1{\cdot}6419 : 1 : 0{\cdot}6354$, $\beta = 67° 33\frac{1}{2}'$, adopting the val. of Prior and Spencer (A., 1895, ii, 507), but halving the c-axis. From a consideration of the morphology, as given by the distribution of the crystal-forms, and from the *X*-ray powder photograph, the space-group is $C_{2h}^3 = C2/m$. The unit cell, of dimensions a 13·10, b 7·96, c 5·06 A., contains $4[Al_2PO_4(OH)_3]$. The optical data agree with those of Prior and Spencer. L. J. S.

Anorthite-epidote-garnet-hornfels from Namaqualand, South Africa. C. B. Coetzee (*Min. Mag.*, 1941, **26**, 134—139).—The hornfels composed of this unusual assemblage of minerals (for which optical data are given) occurs as bands in pyroxene-bearing gneisses. Chemical analysis (SiO_2 41·63, Al_2O_3 25·32, Fe_2O_3 6·33, CaO 22·06%, etc.) suggests that it has been derived from a marl. Analyses are also given of the associated migmatised amphibole-pyroxene-gneiss and of the younger granite-gneiss which induced the metamorphism. L. J. S.

Identity of "eggonite" with sterrettite. F. A. Bannister (*Min. Mag.*, 1941, **26**, 131—133).—"Eggonite" was originally

described by A. Schrauf (1879) as a Cd silicate from Altenberg, Belgium, but it was later found that the crystals had been fraudulently gummed on the specimens of Zn ore. Similar crystals described by J. Krenner (1929) as hydrous Al phosphate were associated with Ag ore from Felsőbánya, Hungary. *X*-Ray examination of old specimens of " eggonite from Altenberg " gave *a* 8·90, *b* 10·24, *c* 5·40 A., *d* 2·44, which, together with earlier crystallographic and optical data, are in agreement with those for sterrettite, $Al_3(PO_4)_4(OH)_6.5H_2O$, from Fairfield, Utah (cf. A., 1941, I, 352). L. J. S.

Kornerupine and its chemistry. M. H. Hey, B. W. Anderson, and C. J. Payne (*Min. Mag.*, 1941, **26**, 119—130).—Four micro-analyses of kornerupine of gem quality from Ceylon (A., 1940, I, 238) and of the " prismatine " variety from Waldheim, Saxony, show SiO_2 29·3—30·5, B_2O_3 2·5—3·6, Al_2O_3 35·8—42·9, Fe_2O_3 0—3·3, FeO 4·8—9·1, MgO 16·4—21·0, Na_2O trace—1·6, K_2O trace—0·6%. New determinations of FeO on the original materials previously analysed from Port Shepstone, Natal (A., 1940, I, 333), and Itrongay, Madagascar, gave 12·22 and 2·55%, respectively, with no Fe_2O_3. Details of the method of analysis, especially for B_2O_3 and FeO, are given. The contents of the unit cell (*a* 13·68, *b* 15·95, *c* 6·68 A.) are given by the general formula $(Al,Mg,Fe^{II},Fe^{III},Na)_{10}(Si,B)_{18}O_{36}$; with a small replacement of Si by Al this is expanded to $\{(Al,Fe^{III})_{20+x+y+z}(Mg,Fe^{II})_{20-x-2y-z}Na_y\}\{Si_{18-x-z}Al_zB_x\}O_{36}$. Optical data are given for the materials analysed and for several other gem specimens from Ceylon. Two types are distinguished: those with 2V 20½—25°, and a pseudo-uniaxial type with 2V 3—8°. Refractive indices are: α 1·665—1·682, β 1·6766—1·696, γ 1·677—1·699; *d* 3·290—3·449. L. J. S.

Microgranular uraninite from Isaka [Japan] and its absolute age. T. Iimori (*Amer. J. Sci.*, 1941, **239**, 819—821).—Uraninite (I) in the Isaka pegmatite is finely dispersed throughout the whole rock body, and is intimately associated with fergusonite. (I) contains UO_3 22·23, UO_2 55·40, ThO_2 3·86, Y earths 14·60, Ce earths 0·41, PbO 1·01, Bi_2O_3 0·00, Fe_2O_3 0·17, Al_2O_3 0·44, SiO_2 0·11, $(Nb,Ta)_2O_5$ 0·74, CO_2 0·28, H_2O 0·50, total 99·75%. The solution of the mineral in dil. HNO_3 gave $2·31 \times 10^{-7}$ g. Ra per g., and the aq. solution obtained from the fused Nb–Ta fraction, $0·7 \times 10^{-10}$ g. Ra per g., giving a Ra : U ratio of $3·43 \times 10^{-7}$ and indicating equilibrium of the Ra and U. The approx. age calc. from the Holmes–Lawson formula is 103×10^6 years. L. S. T.

Densities of molten rocks and minerals. E. B. Dane, jun. (*Amer. J. Sci.*, 1941, **239**, 809—818).—ρ and thermal expansion have been determined for synthetic diopside and synthetic akermanite and for diabase from Vinal Haven and bytownite from Norway by measuring the apparent loss in wt. of a Pt ball suspended in the molten material. Data for NaCl and B_2O_3 at temp. $\geq$1200° are also recorded. The results for diabase are compared with those of other observers. Chemical analyses of the diabases are recorded. Apparatus is described. L. S. T.

Royite, a new variety of quartz, from the Jharia coal-field. N. L. Sharma (*Proc. Indian Acad. Sci.*, 1940, **12**, **B**, 215—220).—*Royite* (I) occurs as long, prismatic, brownish-black or black crystals in the sandstones and shales of the eastern portion of the Jharia coal-field. Chemical analysis [S. C. Nivogy] shows SiO_2 95·78, MgO 2·04, Al_2O_3 1·80, Fe_2O_3 0·14, CaO 0·37, MnO 0·03, TiO_2 trace, total 100·16%, with spectroscopic traces of Co, Ba, and Sr. (I) is regarded as a variety of quartz (II), which it resembles in ρ, hardness, and optical properties. In its paragenesis and crystal habit it resembles low-temp. (II), but its well-developed cleavage and association with biotite indicate that it is high-temp. (II). It differs from all varieties of (II) in showing a characteristic schiller, metallic lustre, and bladed structure. L. S. T.

Potassium salt deposits of the Taimir-Lena area. N. I. Bujalov (*Ann. Sect. Anal. Phys.-Chim.*, 1940, **13**, 377—385).—Certain of the NaCl deposits contain up to 1% of KCl. R. T.

Isotopy of berlinite and quartz. H. Strunz (*Z. Krist.*, 1941, **103**, 228—229).—Berlinite (I) has ω_D 1·523$_5$, γ_D 1·529; from Debye–Scherrer photographs, the lattice is hexagonal, with a_0 4·92, c_0 10·91 A., c_0/a_0 2·217; 3 mols. per unit cell. The properties of (I) correspond closely with those of synthetic $AlPO_4$ (cf. Huttenlocher, A., 1935, 1194), showing that (I) and quartz are isotypical. A. J. E. W.

Synthesis of durangite, $NaAlF(AsO_4)$. F. Machatschki (*Z. Krist.*, 1941, **103**, 221—227; cf. A., 1938, I, 440).—A thick paste of syrupy aq. H_3AsO_4 and finely-powdered cryolite is heated in an autoclave at 200° for 36 hr. Durangite (I) is formed as small green monoclinic crystals, frequently giving crossed twins, or occasionally as plates; the crystals are optically negative and have high n and double refraction and weak pleochroism, with $a : b : c$ (goniometric) = 0·787 : 1 : 0·856, β 115° 46′. Rotation and powder *X*-radiograms give *a* 6·69, *b* 8·66, *c* 7·27 A. ($a : b : c$ = 0·773 : 1 : 840), $\rho_{calc.}$ 3·62. The smaller parameters of natural (I) may be due to replacement of AsO_4''' by PO_4'''. The colour of the synthetic (I) is attributed to V or Cr from the autoclave. The distinction between isomorphism and isotypy is discussed; according to Strunz (cf. A., 1937, I, 432) (I) and titanite should be regarded as isotypical and not isomorphous. A. J. E. W.

Gorceixite in Southern Rhodesia. A. M. Macgregor (*Bull. Imp. Inst.*, 1942, **39**, 399—401).—Gorceixite, ρ 3·185, from the Triassic gravels of Somabula has [E. Golding] SiO_2 1·25, Al_2O_3 37·96, Fe_2O_3 3·76, MgO 1·28, BaO 11·88, CeO_2 7·00, P_2O_5 22·39, H_2O 15·05, total 100·57%. The high % of CeO_2 and the absence of CaO are noteworthy. L. S. T.

Spherosiderite [clay ironstone] deposits of the Lichtenstein Mountain at St. Stefan-Kraubath. K. B. Matz (*Berg- u. Hüttenm. Monatsh.*, 1940, **88**, 102—105).—The geology of the deposits is discussed and typical analyses are given. R. B. C.

Laboratory study of London Clay. L. F. Cooling and A. W. Skempton (*J. Inst. Civil Eng.*, 1941—42, 251—276).—Samples of London Clay taken from an extensive site in the region 40—90 ft. above the bottom of the stratum have been investigated. The clay is of the stiff-fissured type and appears to have been pre-consolidated under a pressure $<$20 tons per sq. ft. Mean vals. and total range of vals. of the most important physical properties are tabulated, and mechanical properties are correlated with H_2O content, liquid and plastic limits, and the unconfined compression test. L. S. T.

Spectroscopic studies of base-exchange materials. A. M. Buswell and B. F. Dudenbostel (*J. Amer. Chem. Soc.*, 1941, **63**, 2554—2558).—From an examination of their infra-red spectra montmorillonites saturated with various cations can be classified into the four types: (i) extreme absorption with $Ca^{\cdot\cdot}$ and $Mg^{\cdot\cdot}$, (ii) appreciable absorption with $Li^{\cdot}$, $K^{\cdot}$, and $Ba^{\cdot\cdot}$, (iii) slight absorption with $H^{\cdot}$ and $Na^{\cdot}$, and (iv) no change on attempted hydration with $NH_4^{\cdot}$ montmorillonite. Clays of low base-exchange capacity contain less bonded (2·92 μ.) and unbonded (2·75 μ.) OH than the higher base-exchange montmorillonites. Clays allowing replacement of structural OH by phosphate absorb 25% $<$ unphosphated clays. $NH_4^{\cdot}$ montmorillonite exhibits a doublet at 3·13 and 3·27 μ. characteristic of NH_4 halides. *X*-Ray data show that (i) the increased base-exchange capacity of greensand on heat-treatment is due to the formation of new particles, (ii) artificial zeolites are amorphous, and (iii) glauconite or greensand is cryst. W. R. A.

Origin of the electric charge of clay particles.—See A., 1942, I, 57.

Sedimentation of clays.—See A., 1942, I, 57.

Isolation of components of North Dakota lignite. L. Zechmeister and W. T. Stewart (*J. Amer. Chem. Soc.*, 1941, **63**, 2851—2852).—Extraction of N. Dakota lignite (30 kg.) with $COMe_2$ and then chromatography [$Ca(OH)_2$] gives a *substance* (12 mg.), $(C_{10}H_{16}O)_n$ (probably n = 3), m.p. 328—330° (slight decomp.; corr.), and *substances* (1—3 mg. each), m.p. 261—264°, 273—274°, 238—240°, 297—298°, and 249—251°, respectively. R. S. C.

Stratigraphical results of pollen analysis of brown coal from Wackersdorf [Germany]. F. Thiergart (*Braunkohle*, 1941, **40**, 407—408).—In two of the brown coal samples pollen and spores were preserved. A list is given of the pollen and spore genera together with the % composition. The pollen composition is discerned in relation to the age of the beds. The Wackersdorf brown coal is correlated with the Upper Miocene brown coal of Grünberg in Silesia. R. B. C.

Microspores in some coals of the productive coal measures in Fife. E. M. Knox (*Trans. Inst. Min. Eng.*, 1942, **101**, 98—107).

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

APRIL, 1942.

I.—SUB-ATOMICS.

Photometry of stars by emission spectra; application to Nova Herculis 1934—35. P. Rossier (*Arch. Sci. phys. nat.*, 1941, [v], **23**, 217—230).—From the sensitivity curve of the photographic plate the photographic intensity of each line can be deduced by means of a photomicrogram and the visual intensity calc. The method is applied to 13 stellar spectrograms; intensities in the green and violet are compared and results for lines due to H, He, O^{++}, Ne, and Sr are tabulated and discussed. N. M. B.

Cosmical abundance of the elements. H. N. Russell (*Nature*, 1941, **148**, 647—649).—An address. L. S. T.

Superposition fringes in the internally reflected light from a Fabry–Perot etalon. S. Mrozowski (*J. Opt. Soc. Amer.*, 1941, **31**, 209—212).—A system of very sharp dark fringes is observed in the spectra formed by both of the first-order reflexions occurring in the quartz plates of a Fabry–Perot etalon. These fringes are complementary to those observed in the light passing through the two non-parallel etalons of equal thickness. They are produced by the passage of the light through the etalon and subsequent reflexion from it in the reverse direction. Two intersecting systems of fringes also appear in the second-order reflexions. The fringe separation is half that of the first-order fringes. A. J. M.

Strongest lines of singly ionised atoms. W. F. Meggers (*J. Opt. Soc. Amer.*, 1941, **31**, 605—611).—$\lambda\lambda$ of the strongest lines in the first spark spectra of the elements are tabulated. O. D. S.

Values of R and of e/m from the spectra of H, D, and He^+. R. T. Birge (*Physical Rev.*, 1941, [ii], **60**, 766—785).—Data of Drinkwater *et al.* (cf. A., 1940, I, 191) on the α lines of H and D are recalc. to obtain R for H and D and, from these, for He and for infinite mass. Explicit equations (some new) are derived for all calculations. The work of Houston (cf. A., 1928, 3) and of Chu (cf. A., 1939, I, 165) is recalc. The change in the revised val. of R_∞ is due mainly to new vals. of n for air, and recent work on this is summarised. The three sets of data lead to vals. of E (at. wt. of the electron) and e/m. All recent precision work on e/m is recalc. Finally 12 different precision vals. of e/m, obtained by 7 different experimental methods, are obtained. There are no serious discrepancies, but almost complete consistency could be obtained by the expedient (without experimental justification) of raising the adopted val. of the Faraday by ~30 coulombs. Recommended vals. are: $R_H = 109{,}677{\cdot}581_2 \pm 0{\cdot}007_5$, $R_D = 109{,}707{\cdot}419_3 \pm 0{\cdot}007_5$, $R_{He} = 109{,}722{\cdot}263 \pm 0{\cdot}012$, $R_\infty = 109{,}737{\cdot}303 \pm 0{\cdot}017$ cm.$^{-1}$ (I.A. scale); $e/m = 1{\cdot}7592 \pm 0{\cdot}0005 \times 10^7$; $E = 5{\cdot}4862_4 \pm 0{\cdot}0017 \times 10^{-4}$. N. M. B.

Self-consistent field, with exchange, for Si IV and Si V. W. Hartree, D. R. Hartree, and M. F. Manning (*Physical Rev.*, 1941, [ii], **60**, 857—865).—Mathematical. Results of solutions of Fock's equations for the normal state of Si V and for 3*s*, 4*s*, 5*s*, 3*p*, 4*p*, 5*p*, 3*d*, 4*d*, 5*d*, 4*f*, and 5*g* states of Si IV are reported. Calc. term vals. for the series electron are in satisfactory agreement with experiment (cf. McDougall, A., 1932, 789). Spin–orbit separations are calc. from the wave functions; they agree satisfactorily with observed vals. for the *p* but not for the *d* and *f* states. N. M. B.

Spectra of Au I and Au II. J. R. Platt and R. A. Sawyer (*Physical Rev.*, 1941, [ii], **60**, 866—876).—The Au spectrum excited in a hollow-cathode discharge in He was photographed with four different spectrographs for the range 600—10,000 A. Full data and classifications for ~500 lines are tabulated, including 237 newly classified in Au I and 83 newly classified in Au II, which involve respectively 32 and 12 new terms. In the Au I spectrum the *ns* and *nd* series are extended to $n = 14$, and new vals. of the $5f^2F$ levels are suggested. The series limit $5d^{10}\,{}^1S_0$ of Au II is calc. as 74,410 cm.$^{-1}$ above the ground state $5d^{10}6s^2S_{\frac{1}{2}}$ of Au I. Several new terms above the series limit have been located. In Au II a resonance triplet (cf. A., 1933, 440) has been confirmed. The lowest six members of the $5d^9\,7p$ group have been found, and the $5d^86s^2$ configuration has been completed. N. M. B.

Zeeman effect data and preliminary classification of the spark spectrum of praseodymium, Pr II. N. Rosen, G. R. Harrison, and J. R. McNally, jun. (*Physical Rev.*, 1941, [ii], **60**, 722—730).—Studies at fields up to 95,000 oersteds over 2400—7100 A. are reported. g and J vals. for 74 Pr II levels from resolved Zeeman patterns of 141 lines were determined. With these data and new $\lambda\lambda$ data a quadratic term array accounting for 312 lines is set up. Results are consistent with available data. The lowest term of Pr II is $f^3(^4I^\circ).s\text{–}{}^5I^\circ_4$. Most of the strong lines showing hyperfine structure arise from the f^3s configuration. N. M. B.

Quenching and depolarisation of mercury resonance radiation by the rare gases. L. O. Olsen (*Physical Rev.*, 1941, [ii], **60**, 739—742).—Results of experiments on quenching and depolarisation of Hg resonance radiation 2537 A. by He, Ne, A, and Kr are tabulated and plotted. Probabilities and cross-sections calc. from formulæ and theory previously reported (cf. A., 1941, I, 398) are given. N. M. B.

Absorption spectrum as a quantitative test for mercury vapour in air.—See A., I, 114.

Principles of quantitative spectrochemical analysis.—See A., 1942, I, 111.

Lundegårdh apparatus [for spectrographic analysis].—See A., 1942, I, 116.

Photometry in spectrochemical analysis.—See A., 1942, I, 117.

Fe $K\beta'$ and $K\beta_5$ lines of FeS_2 and Fe_2O_3. J. C. McDonald (*Physical Rev.*, 1941, [ii], **60**, 912).—A comparison of previous results (cf. A., 1937, I, 3) with those of Yoshida (cf. A., 1941, I, 312). N. M. B.

Scattering of positive alkali ions at an angle of 90° in mercury vapour. J. B. Macelwane (*Physical Rev.*, 1941, [ii], **60**, 762—765).—K, Rb, and Cs ions emitted from a block of Kunsman catalyst were collected, after scattering, on a stationary cylinder, and incident and scattered currents were measured simultaneously. Curves are given and show that scattering increases linearly with the pressure of the Hg vapour, decreases with increasing energy of the incident ions, and decreases with the mass of the incident ions. N. M. B.

Pulses in negative point-to-plane corona. L. B. Loeb, A. F. Kip, G. G. Hudson, and W. H. Bennett (*Physical Rev.*, 1941, [ii], **60**, 714—722).—The pulses reported by Trichel (cf. *ibid.*, 1938, [ii], **54**, 1078) in room air are not found with very fine or polished negative points in dust-free air, but appear to require the presence of a source of triggering electrons. These can be furnished from fine points, or by roughness on larger points through field emission, or by very fine dust specks, and probably by adequate photo-electric or thermionic emission from the point. Trichel's theory is applicable except as modified by the influence of the negative ion space charge and the necessity of triggering electrons. N. M. B.

Fundamental limit of performance of an electron microscope. J. Hillier (*Physical Rev.*, 1941, [ii], **60**, 743—745).—Mathematical. The contrast obtainable in the image of a single atom is limited by diffusion arising from the diffraction defect. If a photographic emulsion can detect a min. of 10% change in intensity, it is shown that a single atom can produce a discernible image only if its at. no. is >25. With the optimum objective aperture the addition of the at. electrons appears to produce only a slight change in this lower limit of at. no. Its val. is increased by the effects of neighbouring atoms, non-parallel illumination, and lens aberrations. N. M. B.

Average energy required to produce an ion pair in xenon with 0·16 A. X-rays. N. L. Walbridge (*Physical Rev.*, 1941, [ii], **60**, 852—856).—Measurements of X-ray energy for λ 0·12—0·24 A. were made with a Pb-disc thermopile absorbing 97% of the incident radiation, and with a thin Ag-disc thermopile absorbing 8·9%. Ionisation was measured in Xe at 2·22 atm. The energy found was $21{\cdot}3 \pm 0{\cdot}8$ e.v. N. M. B.

Photo-electric properties of bismuth. H. Jupnik (*Physical Rev.* 1941, [ii], **60**, 884—889; cf. Weber, A., 1938, I, 378; 1942, I, 29).—Threshold determinations with Fowler plots were made for six Bi surfaces evaporated on glass under high vac. The work function vals. were 4·22—4·25 e.v. There was no significant temp. variation in the range −70° to 200° for λ 2537 A. Vals. of the parameter α, the no. of electrons that strike unit surface area per sec. and absorb a quantum of energy when the light intensity is 1, were 0·03—1 as great as those of Na surfaces. Like those for Na, the vals. of α are ~10^{-2} as great as the upper limit set by Du Bridge if the no. of free electrons per Bi atom is assumed to be 5. N. M. B.

Theory of the cyclotron.—See A., 1942, I, 158.

Effects of heat-treatment on field emission from metals. J. H. Daniel (*J. Appl. Physics*, 1941, **12**, 645—652).—The effects of heat-treatment on field emission from metals may be investigated by means of a cylindrical electron projector tube. Large unstable field currents (anomalous emission) are due to the presence of surface electropositive impurities. It is possible to remove these impurities from W, Ta, or Mo by heating to >2200° K., but they could not be removed from Ni below the m.p. The effect of gas adsorption is small, but even pressures of 10^{-7} mm. increase the frequency of breakdown. This is probably due to a rearrangement or breaking up of impurity layers, or of the metal itself by positive-ion bombardment. The magnitude of anomalous emission is greatly reduced by making the surface microscopically smooth, but such emission cannot be entirely removed by this means. An expression is given for the calculation of the voltage necessary to cause vibration of the filament in a cylindrical electron projector tube when there is a definite voltage between filament and screen. A. J. M.

Production of proton beams. E. S. Lamar, W. W. Buechner, and R. J. van de Graaff (*J. Appl. Physics*, 1941, **12**, 132—140).—Metal and glass capillary ion sources of the diffusion type have been investigated. The average proton yield of a metal source is ~10%, but this is not reproducible, and is probably affected by surface conditions difficult to control. By coating the walls of the discharge tube with a syrupy mixture of P_2O_5 and H_2O, and mixing sufficient H_2O vapour with the H_2 to prevent the coating from drying, the proton yield may be increased to 80%. The coating prevents loss of at. H by diffusion into the cathode and anode regions where recombination takes place on the electrodes. Pyrex sources are more reliable than metal ones, and can be made to give a yield of ~60%. The variation of output with the shape and dimensions of the source and with the arc current is considered. A. J. M.

Sparking of oxide-coated cathodes in mercury vapour. D. D. Knowles and J. W. McNall (*J. Appl. Physics*, 1941, **12**, 149—154).—When an oxide-coated cathode tube of the gas or vapour type passes > a certain current, a spark or cathode spot occurs on the cathode and the tube is damaged. A procedure has been devised for finding how the sparking current is affected by cathode temp. and gas pressure, the duration of the spark being so reduced that the tube is not greatly damaged, and a no. of observations can be made with the tube. At a const. cathode temp. and Hg v.p., the tube drop is a linear function of anode current. Increase in cathode temp. causes a decrease in the slope of the tube-voltage-drop–current curve, and a larger sparking current. The effect of pressure of Hg vapour on the sparking curve was also investigated. The mechanism of sparking is discussed on the basis of the experimental results. A. J. M.

Final measurements of velocity of light. W. C. Anderson (*J. Opt. Soc. Amer.*, 1941, **31**, 187—197).—An earlier method of determining the velocity of light, using a photo-electric cell (cf. A., 1938, I, 550), has been improved. Group velocity is discussed as a correction factor. Electron transit time is a limiting factor for the method. The final result is 299,776±14 km. per sec. The velocity of light is a const. as nearly as can be measured at present. A. J. M.

Mass differences of the fundamental doublets used in the determination of the isotopic weights ^{12}C and ^{14}N. E. B. Jordan (*Physical Rev.*, 1941, [ii], **60**, 710—713; cf. A., 1941, I, 67; Mattauch, A., 1940, I, 337).—In view of discrepancies in available data for the mass val. of ^{12}C, to the determination of which the mass difference $^{12}CH_4$—^{16}O is fundamental, the latter was redetermined by means of a new large spectrograph, giving the val. 363·2±0·35×10^{-4}. Other doublet measurements and vals. (×10^{-4}) are: $^{12}CH_3$—$^{14}N^1H$ 125·63±0·13, $^{12}CH_4$—$^{14}NH_2$ 125·50±0·13, checking the mass difference $^{12}CH_2$—^{14}N 125·60±0·15. N. M. B.

Determination of radium in some igneous rocks.—See A., 1942, I, 113.

Slowing down of low-energy neutrons in water. M. Goldhaber and R. D. O'Neal (*Physical Rev.*, 1941, [ii], **60**, 834).—The experiments of Amaldi (cf. A., 1937, I, 58) on fast neutrons show that the intensities of resonance and C neutrons decrease in a similar manner. Experiments are reported showing that for low-energy primary neutrons there is much less similarity in the curves for resonance and C neutrons. The neutron source was the photo-neutrons (220± 20 ke.v.) produced in Be by the hard γ-rays of radio-Y. At a large distance from the source the intensity of the resonance neutrons decreases much faster than that of the C neutrons. Hence C neutrons practically free from resonance neutrons can be obtained. N. M. B.

Scattering of fast neutrons by lead. H. F. Dunlap and R. N. Little (*Physical Rev.*, 1941, [ii], **60**, 693—701).—Cloud-chamber investigations of the scattering of D–D neutrons by Pb show that the energy distribution of the inelastically scattered neutrons, determined for 0·6—2·0 Me.v., does not agree with the theoretical predictions of Weisskopf (cf. A., 1940, I, 187). The cross-section for inelastic scattering is 1·31±0·53 × 10^{-24} sq. cm. The elastic scattering is not spherically symmetric, and is very small for angles >~50°. N. M. B.

Interaction of slow neutrons with nuclei. H. Carroll (*Physical Rev.*, 1941, [ii], **60**, 702—709; cf. A., 1938, I, 593).—The influence of the mol. binding of the proton was investigated by measuring the total cross-section per proton, for neutrons absorbed by Cd (C neutrons), of a gaseous hydrocarbon series C_nH_{2n+2} and of H_2, H_2O, and solid paraffin. Results show that the cross-section per proton increases rapidly from the val. for the free proton, varying approx. as the square of the reduced mass of the system. The bound proton cross-section for paraffin approaches a limiting val. 2·4 times that for the free proton. The dependence of neutron scattering on structure was investigated for liquid and solid $C_{14}H_{34}$. The marked increase in the cross-section of the liquid over the solid state indicates the presence of much coherent scattering. Total cross-sections of the deuteron in D_2O, and of He, Ne, A, Kr, O, and N were also measured. N. M. B.

Scattering of neutrons by deuterons and the nature of nuclear forces. R. A. Buckingham and H. S. W. Massey (*Proc. Roy. Soc.*, 1941, **A**, **179**, 123—151).—Calculations are made of the angular distributions and effective cross-sections of elastic collisions between neutrons of 2·2 Mv. energy and deuterons at rest. Theoretical vals. have been obtained using fundamental interactions of ordinary and of exchange types, so that the possibility of distinguishing between these types by experiment can be examined. The method and a large no. of the numerical tables can be used in the closely similar problem of the collisions between protons and deuterons. It is concluded that the available experimental results are consistent with the assumption of the existence of exchange forces. G. D. P.

Auto-radiography of ores.—See A., 1942, I, 115.

Recent advances in atomic physics. T. Alty (*Proc. Roy. Phil. Soc. Glasgow*, 1940—41, **65**, 17—27).—A lecture.

Energies of γ-rays from ^{63}Ni, ^{56}Mn, ^{69}Zn, ^{67}Ga. A. Guthrie (*Physical Rev.*, 1941, [ii], **60**, 746—747).—With a focussing magnetic spectrograph the values obtained are ^{63}Ni (2·6 hr.) 0·280±0·007, 0·65±0·01 (both not previously reported), 0·93±0·04; ^{69}Zn (13·6 hr.) 0·440±0·006; ^{67}Ga (83 hr.) 0·292±0·006; ^{56}Mn (2·59 hr.) 0·800± 0·015 Me.v. Fair agreement is shown with vals. reported elsewhere (cf. Helmholz, A., 1942, I, 34; Deutsch, A., 1941, I, 441). N. M. B.

Radioactive isotopes of mercury. C. S. Wu and G. Friedlander (*Physical Rev.*, 1941, [ii], **60**, 747—748; cf. Sherr *et al.*, A., 1942, I, 35).—Slow and fast neutron bombardment of Hg give 25-hr. and 64-hr. activities (the latter new) identical with the Hg fraction from the bombardment of Au with 16-Me.v. deuterons. Absorption in Al showed that both activities emit conversion electrons of max. energy ~200 ke.v. and <90 ke.v., respectively. Crit. absorption measurements of the emitted *X*-rays indicate that both activities are due to ^{197}Hg and that both decay to ^{197}Au by *K* electron capture. Associated with both periods are complex groups of soft γ-rays. A 43-min. period is induced strongly in Hg by fast neutrons, and associated with it is a line of ~460-ke.v. electrons, a group of several γ-rays, and *X*-rays shown to be Hg *K* radiation. The activity is probably associated with an isomeric transition in Hg, and may be ^{199}Hg or $^{201*}Hg$. Slow- and fast-neutron bombardment of Hg gives a 54-day period, probably ^{203}Hg; it emits negative β-particles of 300—350 ke.v. upper energy limit, and γ-rays of ~300 ke.v., but no *X*-rays. N. M. B.

Range–velocity relation for fission fragments in helium. J. K. Bøggild (*Physical Rev.*, 1941, [ii], **60**, 827—830; cf. A., 1941, I, 189).—Curves obtained from individual close collisions and from statistical considerations of the branch frequency are investigated. Comparison with data for tracks in A indicates that the shape of the range–velocity curves for A and He differs appreciably in the last part of the range as expected from theoretical considerations on the relative contributions to the stopping power by electron encounters and nuclear collisions in light and heavy gases. N. M. B.

Preparation and properties of long-lived radio-chlorine. D. C. Grahame and H. J. Walke (*Physical Rev.*, 1941, [ii], **60**, 909).—Intensive slow-neutron irradiation of $NaClO_3$ or $NaClO_4$ kept for ~6 months near a cyclotron target holder gave, after purification and separation as NaCl, an activity of half-life <2 years, with indirect evidence pointing to ~10^3 years. Observable emitted radiations are of very small intensity; cloud-chamber tracks indicate negative electrons, low-energy positrons, and an indication of photo-electrons from soft *X*-rays. The new isotope is probably ^{36}Cl formed by the reaction ^{35}Cl (n,γ) ^{36}Cl. The suggested disintegration along three parallel paths is → ^{36}A + β^-; → ^{36}S + β^+; → ^{36}S + *K* radiation (?). Absorption measurements give an end-point corresponding with an energy of 0·64 Me.v. Production of the isotope by deuteron irradiation of NaCl was unsatisfactory because there was no way to concentrate the active substance. N. M. B.

Nuclear photo-effect on sulphur, aluminium, and magnesium. O. Huber, O. Lienhard, P. Scherrer, and H. Wäffler (*Physical Rev.* 1941, [ii], **60**, 910).—From the energetic viewpoint, photo-disintegration of all nuclei should be possible by means of 17-Me.v. γ-rays

produced in resonance capture of protons by Li. In order to detect possible short-lived activities, S, Al, Mg, and Si were irradiated with these γ-rays, and then, in <2 sec., were submitted to Geiger–Müller counter examination. The reactions and half-lives obtained were: $^{32}S(\gamma,n)^{31}S$ ($2{\cdot}9\pm0{\cdot}2$ sec.); $^{27}Al(\gamma,n)^{26}Al$ ($7{\cdot}2\pm0{\cdot}5$ sec.); Mg, a weak activity obscured by other reactions; Si, no effect. The respective yields relative to $^{60}Cu(\gamma,n)^{62}Cu$ (10·5 mm.) were 14, 11, ~5, and 0%. N. M. B.

Radioactive isotopes of cobalt. J. J. Livingood and G. T. Seaborg (*Physical Rev.*, 1941, [ii], **60**, 913; cf. A., 1941, I, 439).—From available data the following complete assignments and interpretations are made: ^{60}Co (5·3 years) is produced by $^{59}Co(n,\gamma)^{60}Co$, $^{59}Co(d,p)^{60}Co$, and $^{60}Ni(d,a)^{60}Co$; negative β-particles and γ-rays are emitted; the activity is due to β-particle decay from the lower level in ^{60}Co to stable ^{60}Ni. ^{60}Co (10·7 min.) is produced by $^{59}Co(n,\gamma)^{60}Co$ and $^{60}Ni(n,p)^{60}Co$; the radiation is mainly conversion electrons, and the activity is an isomeric transition from an upper to a lower level in ^{60}Co. ^{58}Co (72 days) is produced by $^{55}Mn(a,n)^{58}Co$, $^{58}Ni(n,p)^{58}Co$, $^{57}Fe(d,n)^{58}Co$, $^{57}Fe(p,\gamma)^{58}Co$, and probably $^{58}Fe(a,np)^{58}Co$; the particles are mainly or entirely positive β-particles with upper energy limit 0·4 Me.v.; the γ-ray absorption corresponds with 0·6 Me.v. energy. ^{57}Co (270 days) is produced by $^{56}Fe(d,n)^{57}Co$ and $^{56}Fe(p,\gamma)^{57}Co$; the positron energy is 0·26 Me.v., and conversion electrons are also present in the radiation. ^{56}Co (72 days) results from $^{56}Fe(d,2n)^{56}Co$, $^{58}Ni(d,a)^{56}Co$, and $^{54}Fe(a,np)^{56}Co$, and emits positrons of upper energy limit 1·2 Me.v.; the γ-ray absorption corresponds with 1·05 Me.v. energy. ^{55}Co (18·0 hr.) is produced by $^{54}Fe(d,n)^{55}Co$ and $^{54}Fe(p,\gamma)^{55}Co$, and is the parent of ^{55}Fe. There is no evidence of ^{54}Co from the possible reaction $^{54}Fe(d,2n)^{54}Co$. N. M. B.

Range and ionisation measurements on high-speed protons. R. R. Wilson (*Physical Rev.*, 1941, [ii], **60**, 749—753).—The relative sp. ionisation along an initially mono-energetic 4-Me.v. proton beam was measured. The stopping power of Al relative to air is 1·48 mg. per sq. cm. per cm. of air at 15° and 76 cm. Hg, and independent of the energy for 1·5—4·0 Me.v. This is interpreted theoretically. Measurements of stopping powers of Cu, Fe, Mo, Ni, Pt, Ta, and Zn foils are tabulated. The calc. val. of the mean excitation energy of atoms with many electrons (I in Bethe's formula for the rate of loss of energy of heavy particles by ionisation) is $0{\cdot}85Z(me^4/2\hbar)$ or $Z\times11{\cdot}5$ e.v. N. M. B.

Mass of the meson by the method of momentum loss. J. A. Wheeler and R. Ladenburg (*Physical Rev.*, 1941, [ii], **60**, 754—761).—Measurement of particle mass by observations on track curvature before and after traversal of a known amount of matter is discussed with reference to the meson. The stopping power for fast particles is calc. from Wilson's experiments (cf. preceding abstract), and curves are given for the dependence of range on energy and momentum for fast H and He nuclei and for mesons. Results from the momentum-loss method and by various other methods based on available data are examined. It is concluded that these do not yet establish a uniqueness of meson mass. N. M. B.

Cosmic rays and the magnetic disturbance of September 18, 1941. V. F. Hess and E. B. Berry, jun. (*Physical Rev.*, 1941, [ii], **60**, 746).—An analysis of data from several instruments and comparison with reports on former aurora displays. N. M. B.

Differential measurements of the meson's lifetime at different elevations. G. Bernardini, B. N. Cacciapuoti, E. Pancini, O. Piccioni, and G. C. Wick (*Physical Rev.*, 1941, [ii], **60**, 910—911).—In view of discrepancies in available data, independent of energy distribution assumptions, on meson lifetime, coincidence-counter measurements were made at three different localities of different altitude. Calc. vals. of the proper lifetime r of the meson are $3{\cdot}4\pm0{\cdot}3$, $2{\cdot}55\pm0{\cdot}4$, and $1{\cdot}65\pm0{\cdot}3$ μ-sec. There is evidence that $\mu c^2/r$ increases with altitude and average meson energy. N. M. B.

Electric fields in interstellar space. F. Evans (*Physical Rev.*, 1941, [ii], **60**, 911; cf. A., 1941, I, 95).—A recalculation of previous results on the basis of a formula suggested by Mohler (cf. *ibid.*, 358) for the collision cross-section for at. scattering of electrons. N. M. B.

Penetrating non-ionising cosmic-ray particles. L. Jánossy and G. D. Rochester (*Nature*, 1941, **148**, 531—532).—Experiments showing the existence of penetrating neutral particles at sea-level are described (cf. A., 1941, I, 145). The mean free path of the particles is ~10 cm. of Pb, and the estimated intensity of the beam is 0·03% of the total cosmic-ray beam at sea-level. A possible interpretation of the observations is given. L. S. T.

Cloud chamber investigation of penetrating showers. L. Jánossy, C. B. McCusker, and G. D. Rochester (*Nature*, 1941, **148**, 660).—Results of an investigation of the nature of penetrating showers by means of a deep cloud chamber controlled by a counter system selective for these showers are described. The photographs obtained indicate that all penetrating showers contain associated penetrating particles, and that they do not consist simply of simultaneous mesons, but are complex. L. S. T.

Physical concepts of the meson theory of the atomic nucleus. W. Heitler (*Nature*, 1941, **148**, 680—683).—A review. L. S. T.

Origin of cosmic rays: a hypothesis and the experimental testing of it in India and elsewhere. R. A. Millikan, H. V. Neher, and W. H. Pickering (*Current Sci.*, 1941, **10**, 393—394).—Vertically-incoming cosmic rays are distributed among five energy bands; rays in each band should reach the earth at a crit. latitude and at all higher latitudes, and four "plateaux" of const. cosmic-ray intensity should exist between the successive crit. latitudes. These latitudes are determined by interaction of the particles with the earth's magnetic field. The bands have energies 1·9, 5·6, 6·6, 7·5, and $13{\cdot}2\times10^9$ e.v., and correspond with production of rays by annihilation of the rest-mass energies of He, C, N, O, and Si atoms, respectively, in interstellar space. Evidence in favour of the hypothesis is reviewed. A. J. E. W.

Internal diamagnetic fields. W. E. Lamb, jun. (*Physical Rev.*, 1941, [ii], **60**, 817—819).—Mathematical. The val., at the nucleus, of the magnetic field produced by the diamagnetism of the at. electrons is calc. on the Fermi–Thomas model and checked for a no. of atoms by available Hartree calculations. The statistical treatment gives for the ratio of induced to external field $0{\cdot}319\times10^{-4}Z^{4/3}$, while the numerical coeff. on the Hartree model is lower by 19% at $Z=19$ and by 12% at $Z=80$. The effect is equiv. to a reduction of the nuclear g val. by a factor $(1-0{\cdot}319\times10^{-4}Z^{4/3})$, and in this form the correction may be applied in the calculation of hyperfine structure of heavy atoms. The influence of the diamagnetic fields on an orbital electron is shown to be equiv. to a reduction in the g val. of an outer s electron of the same order of magnitude as the relativistic correction (cf. Margenau, A., 1937, I, 191). N. M. B.

Pseudoscalar mesotron theory of β-decay. E. C. Nelson (*Physical Rev.*, 1941, [ii], **60**, 830—833).—Mathematical. Sakata's calculations (*Proc. Phys. Math. Soc. Japan*, 1941, **23**, 291) which indicate that the theory can account for both mesotron decay and β-decay are shown to be in error. The theory gives the correct spin and parity selection rules for β-decay, but also gives β-decay lifetimes too long by a factor 10^6 and having an inverse-seventh-power dependence on the upper limit of the β-spectrum. These conclusions can be made when the mesotron field is strongly coupled to nuclear particles, and show that pseudoscalar mesotrons are not responsible for β-decay. N. M. B.

Meson theory and nuclear forces. H. Wergeland (*Physical Rev.*, 1941, [ii], **60**, 835—836).—Mathematical. The possibility that the diverging terms in the nuclear interaction predicted by meson theory may have a significance analogous to the magnetic interaction between electrons was discussed and discarded by Bethe (cf. A., 1940, I, 190), but such terms cannot be considered simply as part of an energy operator in configuration space (cf. Breit, A., 1932, 441) and it is suggested that the meson interaction and Breit's operator have a similar origin. To demonstrate this a modified derivation of nuclear forces from field theory is presented. N. M. B.

α-Model of nuclear structure, and nuclear moments. D. R. Inglis (*Physical Rev.*, 1941, [ii], **60**, 837—851).—Criticism of the α-model (cf. Grönblum, A., 1939, I, 176; Margenau, A., 1941, I, 94) based on the conventional assumption of nuclear forces with several exchange terms and a single-range parameter is controverted by a calculation based on a more satisfactory assumption of nuclear forces with fewer terms and two-range parameters; this leads to an adequate first-order attraction between the α-particles. Observed regularities among nuclear moments are qualitatively explained, and other consequences of the model are discussed. The occurrence of large positive electric quadrupole moments only in the neighbourhood of the rare earths is related to the shape of an α-framework and to the participation of only one or very few particles in the orbital motion. N. M. B.

Collision relations. L. A. Pars (*Phil. Mag.*, 1942, [vii], **33**, 96—101).—A geometrical method is given of proving and exhibiting directional and velocity relations resulting from collisions of the first and second kind between, *e.g.*, α-particles and at. nuclei. L. J. J.

Forces on an electron according to Dirac's wave equation. A. Lees (*Phil. Mag.*, 1942, [vii], **33**, 131—137).—Mathematical. The forces on an electron are proved to consist of a purely internal system of stresses together with classical external electromagnetic field forces. L. J. J.

II.—MOLECULAR STRUCTURE.

Relation between potential energy and interatomic distance in diatomic molecules. II. J. W. Linnett (*Trans. Faraday Soc.*, 1942, **38**, 1—9).—The extension of the function $V=a/r^m-be^{-nr}$ (cf. A., 1941, I 25) from the first short period to mols. involving atoms in other periods is discussed. When suitable expressions are used to obtain the vals. of the consts. this function gives a relation by which r_e can be derived from observed vals. of the vibration frequency. The results are less satisfactory for mols. in which one atom is in group 2 or 3 and the other in groups 4—7 than for those in which

both atoms are in groups 4—7, owing to the less exact data available for the former. F. L. U.

Isotope effect in the predissociation phenomena of CH and CD. L. Gerö and R. F. Schmid (*Physical Rev.*, 1941, [ii], **60**, 911—912).—The locating of the positions of several limiting curves of predissociation has extended and improved results previously reported (cf. A., 1941, I, 237). A comparison of predissociation effects in the CH and CD spectra shows that the graphs of corresponding limiting curves of predissociation can be brought into coincidence for both mols. only by lowering the equilibrium position of the CD ground state by ~350 cm.$^{-1}$ units relative to that of the CH mol. As the electronic isotope effect is very small, the energies in the equilibrium positions of all CD states must be lowered by approx. the same val. Increases in dissociation energy are also found for AlD and CaD. A group of lines in the CH spectrum at ~4324 A. was identified as the (2,2) band of the $^2\Delta \rightarrow {}^2\Pi$ system. The corresponding CD band is discussed. N. M. B.

Isotope effect in OH and OD bands. M. G. Sastry (*Current Sci.*, 1941, **10**, 362—363).—Vibrational and rotational isotope shifts calc. from the mass factor are compared with observed total shifts for 10 band heads. The poor agreement is attributed to spin coupling and electronic interaction with rotation and vibration. A. J. E. W.

Rotational structure of the Birge–Hopfield bands of nitrogen. J. W. T. Spinks (*Canad. J. Res.*, 1942, **20, A**, 1—5).—The bands were photographed in the third order of a 3-m. grating. Wave nos. and assignments of the $2 \rightarrow 10$, $3 \rightarrow 11$, $4 \rightarrow 12$, $5 \rightarrow 13$, $5 \rightarrow 14$, and $6 \rightarrow 14$ bands of the $a\,{}^1\Pi_u \rightarrow X\,{}^1\Sigma_g^+$ system of N_2 are tabulated, and rotational consts. are given. The occurrence of *P*, *Q*, and *R* branches confirms the transition as $^1\Pi \rightarrow {}^1\Sigma$. N. M. B.

$^2\Pi_u \rightarrow {}^2\Pi_g$ bands of CO_2^+. I. S. Mrozowski (*Physical Rev.*, 1941, [ii], **60**, 730—738).—A study of the emission band spectrum in the region λλ 2900—4300 is reported. Excitation conditions agree with former results (cf. Duffendack, A., 1929, 969). The bands, obtained with great intensity, were photographed in the second order of a 30-ft. grating. A preliminary rotational and vibrational analysis is given, with wave nos., and origins of the bands, analyses of 5 double bands of the $v_1'' = v_2'' = v_3'' = 0$ progression of the symmetrical vibration (v_1' varying, $v_2' = v_3' = 0$), rotational consts., and vibrational intervals. N. M. B.

Further resolution of two parallel bands of ammonia and the interaction between vibration and rotation. H. Y. Sheng, E. F. Barker, and D. M. Dennison (*Physical Rev.*, 1941, [ii], **60**, 786—794).—A re-examination under high dispersion of the fundamental low-frequency parallel band at 10 μ. and its upper-stage band at 16 μ. shows that most of the fine-structure lines hitherto reported as single are resolved into multiplets. An energy-level expression accounting accurately for the positions of the lines is given, and consts. are determined. The rotational consts. are discussed mathematically with reference to the average consts., averaged over the two levels of the double min., and the difference of the consts. A treatment of the latter is equiv. to a treatment of the change in the splitting of the two levels of the double min. due to the vibration–rotation interaction. The calc. and observed change in splitting of the first vibration levels are in close agreement. N. M. B.

Vibration–rotation energies of polyatomic molecules. H. H. Nielsen (*Physical Rev.*, 1941, [ii], **60**, 794—810).—Mathematical. The quantum Hamiltonian *H* for the general vibrating–rotating polyat. mol. of *N* atoms is expanded by the Wilson–Howard method (cf. A., 1936, 667) to second order of approximation. Solutions of the Schrödinger equation $(H - E)\psi = 0$ for asymmetric mols., axially symmetric mols., and linear mols. are obtained. Expressions for the anharmonic terms occurring in the vibration energy, the effective moments of inertia, the amplitudes of the internal angular momentum of oscillation, and the centrifugal distortion coeffs. are derived, so that when the normal co-ordinates are known the vibration–rotation energies of a polyat. mol. may be calc. from the results given. N. M. B.

Spectroscopic evidence of hydrogen bonds in hydrogen peroxide and hydrazine. P. A. Giguère (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, III, 1—8).—In liquid H_2O_2, the absorption max. 9720 A. of the vapour is shifted to 10,110 A. The corresponding shift in liquid N_2H_4 is much smaller, the liquid giving flat max. at ~10,700—10,600 A., 10,340 A., and 10,225 A. N_2H_4,H_2O shows a shift of ~50 cm.$^{-1}$ of the N–H components towards higher frequencies in the liquid. Comparison of m.p., b.p., and heats of vaporisation of H_2O_2 and N_2H_4 with those of isoelectronic hydrides suggests strong association. L. J. J.

Near infra-red spectra of linear Y_2X_2 molecules. I. Theory. W. H. Shaffer and A. H. Nielsen (*J. Chem. Physics*, 1941, **9**, 847—852).—Expressions for the vibration–rotation energies of X_2Y_2 mols. have been obtained in the form $E = hc(G_V + F_B)$. The vibrational term G_V agrees with recorded vals. but the rotational term F_B shows differences. W. R. A.

Absorption spectra of para- and dia-magnetic nickel complexes. J. E. Mills and D. P. Mellor (*J. Amer. Chem. Soc.*, 1942, **64**, 181—182).—The absorption spectra of diamagnetic complexes in which Ni is linked to two N and two O atoms exhibit a band of appreciable intensity attributed to Ni, and the bands of the co-ordinated chelate mol. are slightly displaced, usually to longer λλ. Paramagnetic complexes of Ni show no band attributable to Ni, and the observed absorption bands appear to be those of the org. chelate mol. displaced to longer λλ. W. R. A.

Changes in the absorption spectrum of lead and nickel films at low temperatures. C. F. Squire (*J. Appl. Physics*, 1940, **11**, 779—780).—The absorption spectra of thin films of Au, Cu, Cd, Al, Sn, Sb, Pb, and Ni at 298° and 80° K. have been compared. No influence of temp. was observed for metals other than Pb and Ni. Pb shows increased transmission in the ultra-violet at 80° K. Ni shows a decreased transmission in the visible at 80° K. O. D. S.

Far ultra-violet spectrophotometric studies of fatty acids by photoelectric and spectrographic methods. D. M. Kerns, R. Belkengren, H. Clark, and E. S. Miller (*J. Opt. Soc. Amer.*, 1941, **31**, 271—279).—Quant. absorption spectra data are given for conjugated and non-conjugated alcohols, acids, and esters between λ 2800 and 2000 A. These absorption curves can be used as practical reference standards for the determination of the substances to which they refer in mixtures. At least one new fatty acid has been detected in liver-lipins from a fasted rat. It is not present in sufficient quantities to be measured in normal animals. The importance of stray light in the investigation of absorption spectra in accounting for discrepancies in the literature is discussed. A. J. M.

Oscillator strengths for the liquid phase. A. I. Mahan (*J. Opt. Soc. Amer.*, 1941, **31**, 248—259).—Methods involved in evaluating oscillator strengths of liquids from both dispersion and absorption equations are discussed. The resulting equations have been applied to infra-red bands of CH_2Cl_2, CH_2Br_2, and CH_2I_2. The abs. vals. obtained by the two methods show large discrepancies, but they show the same trend when the sets of vals. for the three compounds are compared. A. A. E.

Absorption spectra of the cyclic dienes in the vacuum ultra-violet. W. C. Price and A. D. Walsh (*Proc. Roy. Soc.*, 1941, **A, 179**, 201—214).—The spectra of *cyclo*hexadiene (**I**), *cyclo*pentadiene (**II**), pyrrole, thiophen, and furan were investigated. The observed bands are due to the excitation of a π electron from the conjugated double bond electrons. Ionisation potentials are deduced. The structure of the mols. is discussed and it is concluded that only in the case of furan is there marked tendency towards homocyclic conjugation. It is thought that " hyperconjugation " plays a smaller part in the interpretation of the spectra of (**I**) and (**II**) than previously supposed. G. D. P.

Ultra-violet absorption spectra of the monomethylchrysenes. W. R. Brode and J. W. Patterson (*J. Amer. Chem. Soc.*, 1941, **63**, 3252—3255).—The ultra-violet absorption spectra of chrysene and its six Me_1 derivatives have been determined and show marked similarities, except that in 4- and 5-methylchrysene steric hindrance produces greater bathochromic and hypochromic shifts. W. R. A.

Negatively polarised emission of gelatin–dye phosphors. P. Fröhlich and L. Gombay (*Kolloid-Z.*, 1941, **94**, 147—152).—Dry gelatin films containing 0·03—3 wt./vol.-% of rhoduline-orange N, rhoduline-yellow, methyl-violet 5 B, Na eosin, or erythrosin show either negatively polarised fluorescence or zero polarisation when excited with plane-polarised light, provided they have been cooled below a certain crit. temp., which depends on the dyestuff and its concn. On slowly raising the temp. from −180° the polarisation becomes less negative or more positive, reaches a max., and then falls to a const. val. The abs. val. of the degree of polarisation, whether negative or positive, increases with diminishing concn. If the films are previously heated at 100° they exhibit neither negative polarisation nor the positive max. F. L. U.

Light absorption in gelatin–dye phosphors and Beer's law. (Miss) H. Mischung (*Kolloid-Z.*, 1941, **94**, 153—157).—For dry gelatin films containing rhoduline-orange N Beer's law is valid, for λλ 254—546 mμ., only at concns. >0·003 g. per c.c.; below this the extinction increases as the concn. decreases. It is suggested that that part of the absorption which is responsible for the deviation from Beer's law is used to excite fluorescence. F. L. U.

Luminescence of meteorites.—See A., 1942, I, 120.

Supersonic cell fluorometer.—See A., 1942, I, 116.

Resonance and isotope effect in the Raman spectrum of carbon disulphide. L. Giulotto and P. Caldirola (*Z. physikal. Chem.*, 1941, **B, 49**, 34—42).—The Raman spectrum of liquid CS_2 has been investigated with high dispersion; it consists of two bands, the stronger having two components, 653·5 and 645·2 cm.$^{-1}$, and the weaker two components at 794·5 and 802·5 cm.$^{-1}$ Frequencies and intensities are in good agreement with Fermi's resonance theory. Each band shows a third component at 642 and 783 cm.$^{-1}$ which arises from the presence of ^{34}S. A weak displacement of 393 cm.$^{-1}$ corresponds with the forbidden transition ω_2. W. R. A.

Raman spectra of substituted sulphuric acids. I. J. Gupta and A. K. Majumdar (*J. Indian Chem. Soc.*, 1941, **18**, 457—460).—Raman spectra of $NH_2{\cdot}SO_3H$ and $NH_2{\cdot}SO_3Na$ are similar but are in some disagreement with the results of Angus *et al.* (A., 1938, I, 435). The structure is tetrahedral as in the sulphates. Force consts. are calc. and the possibility of the formation of $NH_3{\cdot}SO_3'$ is considered. F. R. G.

Effect of silver ion co-ordination on the Raman spectra of some unsaturated compounds. H. J. Taufen, M. J. Murray, and F. F. Cleveland (*J. Amer. Chem. Soc.*, 1941, **63**, 3500—3503).—Raman spectra of the following co-ordination complexes of $Ag^{\cdot}$ ion support the formulation proposed by Winstein and Lucas (A., 1938, II, 224): *cis*- and *trans*-Δ^{β}-butene, *cyclo*pentene, *cyclo*hexene, ethyl-, propyl-, amyl-, and phenyl-acetylene, and C_6H_6. For all, except the C_6H_6 complex, solutions in conc. $AgNO_3$ were used. The C_6H_6 complex was examined in conc. $AgClO_4$ solution. The double-bond frequency in olefinic complexes is lowered by ~65 cm.$^{-1}$; the triple-bond frequency in acetylenic complexes is lowered by ~100 cm.$^{-1}$, and in the C_6H_6 complex the C–C stretching frequencies are significantly affected. W. R. A.

Elastic after-effects and dielectric absorption in glass. N. W. Taylor (*J. Appl. Physics*, 1941, **12**, 753—758).—The relation between mechanical and dielectric strain in glasses is discussed. A parallel is drawn between delayed elastic adjustment in a stabilised glass (cf. A., 1941, I, 203) and the anomalous charging current accompanying dielectric polarisation (cf. Murphy and Lowry, A., 1930, 685). In general "memory" phenomena, such as the reversal of discharge current from a glass condenser, result from superposition of two or more independent operations with different relaxation times and directions, corresponding in the case of a glass with the orientation of independent structural units of different sizes. The effects discussed thus support *X*-ray and other evidence for a random ionic network in glass. A. J. E. W.

Orientation polarisation and formation of supermolecules. H. Dunken, F. Judenberg, and K. L. Wolf (*Z. physikal. Chem.*, 1941, **B, 49**, 43—63).—By means of the law of mass action the dependence of orientation polarisation (P_o) on concn. has been quantitatively computed for the complete concn. range. The method gives a simple relationship and explanation of empirically derived formulæ connecting P_o and concn. More work on equilibrium const. and accurate measurements of dielectric const. is urged. W. R. A.

Dipole moments and structures of five organometallic halides. P. F. Oesper and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 173—175).—The following vals. for solutions in C_6H_6 at 25° are given: $GePh_3Br$ 2·35, $SnPh_3Cl$ 3·28, $CH_2Ph{\cdot}HgCl$ 3·05, $SbPh_3Cl_2$ (**I**) 1·19, $BiPh_3Cl_2$ (**II**) 1·17 D. Min. vals. for the metal–halogen bond moments have been calc. and used to estimate the min. amounts of ionic character in the Ge–, Sn–, and Hg–halogen linkings. The small vals. for (**I**) and (**II**) suggest that these mols. possibly do not have a symmetrical, trigonal, bipyramidal structure. W. R. A.

Anomalous dispersion of dipolar ions. H. O. Marcy, 3rd, and J. Wyman, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3388—3397).—Using a new oscillograph method (described), the relaxation times of lysylglutamic acid and triglycine at 115 megacycles are 4·31 and 1·29 × 10^{-10} sec., respectively, compared with 2·45 and 1·4 × 10^{-10} sec., calc. from Stokes' formula assuming that the mols. are rigid spheres. Both mols. would, therefore, appear to orient as rigid bodies in an applied electric field and there is no significant internal rotation in either mol. in periods shorter than those corresponding with the crit. frequencies. W. R. A.

Simple refractometer.—See A., 1942, I, 116.

Refraction and dispersion of glasses.—See A., 1942, I, 92.

Refractive index of liquid water in the near infra-red. M. Centeno V. (*J. Opt. Soc. Amer.*, 1941, **31**, 244—247).—n for liquid H_2O has been calc. using the more accurate vals. of the reflectivity and extinction coeff. now available. The principal max. are 1·525 at 3·07 μ. and 1·358 at 6·20 μ., and the principal min. are 1·187 at 2·74 μ., 1·242 at 5·85 μ., and 1·110 at 11·47 μ. A. J. M.

Optical properties of rubber. L. A. Wood (*J. Appl. Physics*, 1941, **12**, 119—126).—A review of the optical properties of rubber, dealing with absorption, scattering, n, and double refraction, is given. Data for the transmission of milled pale crêpe rubber and a soft vulcanised rubber compound are given for λλ 400—750 mμ. The apparent absorptive index at a given λ decreases with increasing thickness of specimen. For the particular compound used, vulcanisation increases the transmission at shorter λλ and decreases it at the longer λλ. The variation of n of pale crêpe rubber with λ was investigated by using rubber prisms in a spectrometer. $n_F - n_C$ is a little higher for rubber than for glass. For unvulcanised rubber its val. is 0·01315 at 25°, which is not far removed from that for unconjugated diolefine hydrocarbons of low mol. wt. The mol. refractivity confirms the chemical observation of the existence in the rubber mol. of a C_5H_8 unit containing one double linking. A. J. M.

Thermal conductivity of dielectrics. I. Pomeranchuk (*Physical Rev.* 1941 [ii], **60** 820—821).—Mathematical. The Peierls–Debye relation, the thermal conductivity $\kappa \propto 1/T$, when $T \gg \theta$ (the Debye temp.), is true only for dielectrics obeying the laws of sound velocity dispersion and dependence of sound velocity on direction. For all other dielectrics at $T \gg \theta$, $\kappa \propto 1/T^{3/2}$. N. M. B.

Heat of sublimation of carbon and some absorption bands of three mesomeric hydrocarbons. G. J. Kynch and W. G. Penney (*Proc. Roy. Soc.*, 1941, **A, 179**, 214—231).—Spectroscopic analysis of the CO spectrum and thermochemical measurements on the burning of C in O_2 indicate that L, the heat of sublimation of C, is either 124 or 170 kg.-cal. per mol. An estimate of L is made by calculating the energies of excited states of C_6H_6, butadiene, and hexatriene, and agreement with experiment is found with $L = 170$. The equilibrium internuclear distances in the excited states are found and the potential function controlling some of the vibrations about these positions is determined. The excited state of C_6H_6 has the regular hexagonal configuration with a C—C distance of 1·45 A. compared with 1·39 in the ground state. The C breathing frequency in the excited state is calc. to be 920 cm.$^{-1}$, in fair agreement with experiment. G. D. P.

Structure–property relations of isomeric octanols.—See A., 1942, II, 128.

Momentum distribution in molecular systems. VI. Shape of the Compton line for methane. C. A. Coulson and W. E. Duncanson (*Proc. Camb. Phil. Soc.*, 1942, **38**, 100—108; cf. A., 1941, I, 450).—Vals. for the mean radial distribution of momentum in the CH_4 mol. have been calc. using, respectively, the electron pair, the mol. orbital, and the self-consistent field approximations to the wave function of the mol. The shape of the Compton profile is deduced in each case. The relative accuracy of the three approximations is discussed. Compton profiles are in each case narrower than the experimental val. of Hughes and Starr (A., 1939, I, 230). The lack of agreement may be partly due to incorrect interpretation of the experimental results from which the latter is deduced. O. D. S.

Molecular structures of the dimerides of aluminium dimethyl chloride, aluminium dimethyl bromide, and aluminium trimethyl, and of hexamethyldisilane. L. O. Brockway and N. R. Davidson (*J. Amer. Chem. Soc.*, 1941, **63**, 3287—3297).—Si_2Me_6 has been prepared by a new method; its v.p. is given by $\log_{10} p = -1920/T + 7{\cdot}807$, b.p. (extrapolated) 109°. Electron diffraction by $Al_2Me_4Cl_2$, $Al_2Me_4Br_2$, Al_2Me_6, and Si_2Me_6 has been investigated and results are compared with those for Al_2Cl_6 and Al_2Br_6. Bond lengths and valency angles have been computed. In the halides the X–Al–X angle is ~90° and the C–Al–C angle 115—135°. The Al Me halides have the bridged structure of two metal and two halogen atoms in a ring. Al_2Me_6 and Si_2Me_6 have structures similar to C_2H_6. Si_2Me_6 has the bond lengths and angles expected for a covalent structure. The C–Al–C angle in Al_2Me_6 is ~115° and the Al—Al bond lengths are < would be expected by comparison with the Si—Si bond length. The joining together of two $AlMe_3$ mols. to give Al_2Me_6 cannot be explained. W. R. A.

Electron diffraction investigation of the molecular structures of silicon tetrabromide, tribromosilane, and dibromodifluorosilane. R. Spitzer, W. J. Howell, jun., and V. Schomaker (*J. Amer. Chem. Soc.*, 1942, **64**, 62—67).—Electron diffraction measurements on $SiBr_4$, $SiHBr_3$, and SiF_2Br_2 indicate that the Si—Br distance in each is 2·16 ± 0·03 A. and the angle Br–Si–Br is approx. the tetrahedral angle. W. R. A.

Molecular surface energy of sulphur dioxide addition compounds. I. J. R. Bright and J. J. Jasper (*J. Amer. Chem. Soc.*, 1941, **63**, 3486—3488).—ρ and γ for the compound $NPhMe_2,SO_2$ have been measured from 0° to 30° and equations for the temp. coeff. of ρ and γ are given. The parachor is 405·4. Possible electronic structures are considered and a structure containing a N–O linking is favoured. W. R. A.

Relationship between refractive index and surface tension. R. C. Tripathi (*J. Indian Chem. Soc.*, 1941, **18**, 411—414).—The Lorentz–Lorenz formula for mol. refraction is combined with Sugden's parachor equation to give $(n^2-1)(n^2+2) = [R]\gamma^{1/4}/[P]$. Differences between observed and calc. vals. of γ are <3%. F. R. G.

III.—CRYSTAL STRUCTURE.

Anomalous reflexions in *X*-ray patterns. G. D. Preston (*Proc. Roy. Soc.*, 1941, **A, 179**, 1—7).—The occurrence of diffuse background reflexions on Laue photographs is discussed with particular reference to those which increase in intensity at elevated temp. It is shown that an elastic wave in the crystal will produce a background; in order to avoid the theoretical difficulties it is suggested that the effects can be explained by supposing the crystal to be composed of a no. small nearly rigid blocks (cf. A., 1939, I, 553), but this view is only an approximation to the complete theory. The geometrical significance of Faxén's rule is briefly discussed. G. D. P.

Experimental study of diffuse *X*-ray reflexion by single crystals. (Mrs.) K. Lonsdale and H. Smith (*Proc. Roy. Soc.*, 1941, **A, 179**, 8—50).—A brief historical outline of the subject is given. Numerous

Laue, oscillation, and rotation photographs (reproduced) are discussed, and rules for indexing the diffuse reflexions are given. The relations of the intensity, shape, and size of the diffuse spots to the nature, structure, perfection, orientation, and temp. of the crystal are considered in detail. Experiments carried out at low temp. show that, except in the case of diamond, the diffuse pattern is practically non-existent at liquid air temp. The use of the diffuse-spot pattern as a subsidiary method of crystal-structure determination is emphasised. It is pointed out that in reciprocal space each lattice point is surrounded by a region of diffuse scattering the physical significance of which is open to various interpretations. These regions are not in general spherical, but extend along reciprocal lattice planes and axes. G. D. P.

Diffuse spots in *X*-ray photographs. (Sir) W. H. Bragg (*Proc. Roy. Soc.*, 1941, **A**, **179**, 51—60).—The possibility of interpreting the diffuse pattern by diffraction due to a small group of atoms is considered. The patterns of KCl, diamond, and calcite are analysed in some detail and good agreement with the observed spots is found. G. D. P.

Diffuse spots in *X*-ray crystal photographs. (Sir) W. H. Bragg (*Proc. Roy. Soc.*, 1941, **A**, **179**, 94—101; cf. A., 1941, I, 402).—The pattern of diamond is analysed in detail and is found to conform to that to be expected from small groups of atoms. Although calculation indicates the presence of some spots where none are observed the agreement of the simple diffraction formula with observation prompts the question as to the reason for this success. The formula suggests the presence of small groups, and any other explanation must describe a condition which simulates the effects of such groups. G. D. P.

Diffraction of monochromatic *X*-rays by crystals at high temperatures. (Sir) W. L. Bragg (*Proc. Roy. Soc.*, 1941, **A**, **179**, 61—64).—The attempt to explain the diffuse spots observed in the patterns of crystals at high temp. by diffraction in a small group of atoms leads to difficulties in accounting for the sharpness of the Laue spots. It is better to treat the crystal and the elastic waves set up by the temp. vibrations as a diffracting unit. A qual. treatment of the mathematical theory of Debye and Waller is given; it explains the presence of the diffuse spots without impairing the sharpness of the normal reflexions. G. D. P.

Diffuse reflexion of *X*-rays by crystals. C. G. Darwin (*Proc. Roy. Soc.*, 1941, **A**, **179**, 65—66).—The diffuse spot pattern should be explicable by the Faxén–Waller theory, but it is possible that the formal analysis may become uninformative and that to ascribe the effects to diffraction by small rigid groups of atoms may still be a convenient way of describing the positions of the diffuse spots. It is not clear that the partial disorder of the small groups must spoil the sharpness of the Laue spots. G. D. P.

Diffuse reflexions of *X*-rays by crystals. G. I. Finch (*Proc. Roy. Soc.*, 1941, **A**, **179**, 67—68).—Somewhat similar effects to those described as diffuse *X*-ray reflexions have been observed by the method of electron diffraction (cf. A., 1939, I, 307). Both effects depend on imperfections introduced into the crystal by thermal agitation. The pattern observed by electron diffraction does not seem to have been observed by *X*-rays although this should be possible. G. D. P.

Effect of thermal vibrations on the scattering of *X*-rays. M. Born and (Miss) K. Sarginson (*Proc. Roy. Soc.*, 1941, **A**, **179**, 69—93).—The hypotheses proposed by Raman and Nilakantan and by Preston and Bragg are discussed; it is considered that the phenomena should be explained by the original theory of Debye. This theory is developed afresh, and expressions are obtained for the position and intensity of extra spots. The formulæ used by Sir William Bragg are a result of the theory. G. D. F.

Temperature diffuse scattering. W. H. Zachariasen (*Physical Rev.*, 1941, [ii], **60**, 691).—Results previously reported (cf. A., 1941, **I**, 325) are shown to be identical with those of Born and Sarginson (cf. preceding abstract), whose conclusions are critically examined. N. M. B.

***X*-Ray diffuse reflexions from sodium and lithium in relation to elastic anisotropy.** (Mrs.) K. Lonsdale and H. Smith (*Nature*, 1941, **148**, 628—629).—Photographs (reproduced) of diffuse *X*-ray reflexions from single crystals of Li and of Na at various temp. show elaborate patterns of spots and streaks which are temp.- but not structure-sensitive. The diffuse spot detail for Na supports Jahn's theory (A., 1941, I, 195). The detail for Li is similar to that of Na, showing that the elastic consts. are of the same order of magnitude and anisotropy for both metals. Laue and rotation photographs of the single crystals do not support the view that Li is not isomorphous with Na. L. S. T.

Graphical method for selecting suitable radiations for the precision determination of non-cubic lattice constants and for indexing back-reflexion lines in powder *X*-ray photograms. L. A. Carapella (*J. Appl. Physics*, 1940, **11**, 800—805).—Charts are illustrated and their use is described. O. D. S.

Structure of liquid metals. A Latin (*Nature*, 1941, **148**, 616—618).—A review. L. S. T.

Position of carbon atoms in austenite. N. J. Petch (*Iron & Steel Inst.*, 1942, *Advance copy*, 13 pp.).—*X*-Ray powder photographs of austenite show that the possible positions for C are at the centres of the unit cells and at the mid-points of the edges. The amount of C present is insufficient for each available position to be occupied, only ~1/12 of the positions being occupied in the case of a steel containing 1·7% of C. Other theories of the structure are discussed. C. R. H.

Cadmium–bismuth oxide with imperfect oxygen lattice. L. G. Sillén and B. Sillén (*Z. physikal. Chem.*, 1941, **B**, **49**, 27—33).—From a quickly cooled melt of CdO and Bi_2O_3 a body-centred, cubic phase was obtained, the cell of which contained 8 mols. of $Cd_xBi_{2-2x}O_{3-x}$. *X*-Ray and ρ measurements indicate vacant positions in the O lattice, whereas the metal lattice is completely filled. The arrangement of the O atoms is discussed. W. R. A.

Crystalline structure of Pt_3O_4. E. E. Galloni and A. E. Roffo, jun. (*J. Chem. Physics*, 1941, **9**, 875—877).—By *X*-ray diffraction it is shown that Pt_3O_4 crystals have a body-centred cube symmetry, 2 mols. per unit cell, edge of cube 6·226 A. W. R. A.

Chain structure of linear polyesters. Trimethylene glycol series. C. S. Fuller, C. J. Frosch, and N. R. Pape (*J. Amer. Chem. Soc.*, 1942, **64**, 154—160; cf. A., 1939, I, 601).—The trimethylene glycol polyesters of succinic, glutaric, adipic, pimelic, suberic, azelaic, and sebacic acids, and of 1 : 9- (**I**), 1 : 10- (**II**), and 1 : 16- (**III**) -dicarboxylic acids have been examined by *X*-ray analysis in the unstretched and stretched fibre forms. In the cryst. regions, the chain mols. are planar, zigzag, and inclined at ~30° to the fibre axis. In the amorphous regions, disordered kinked chains are observed. Mesomorphic states, in which the chains are parallel but otherwise unordered, were detected, particularly with (**III**). In the oriented state and in the absence of external stress, the crystallites are disposed with dipole layers perpendicular to the fibre direction. Stretching along the fibre direction decreases the inclination of the chains to the fibre axis and the formation of dipole layers inclined to the axis, resulting under certain conditions in a complete parallel alinement of the chain mols. (**I**) and (**II**) have been examined by electron diffraction methods and the results support the *X*-ray data. W. R. A.

Size and shape of humic acid crystallites. R. Jodl (*Brennstoff-Chem.*, 1941, **22**, 256—257).—The crystallites in a prep. of Cassel-Brown humic acid when examined by *X*-rays were found to be ~8 A. high and ~25 A. in diameter, *i.e.*, disc-shaped. R. B. C.

Demonstration of growing oxide layers on iron by means of the electron tester. M. Knoll (*Physikal. Z.*, 1941, **42**, 120—122).—If Fe which has been heated to redness in vac. is exposed for a short time to air, its secondary emission, as determined by the electron "tester," increases. A greater increase in secondary emission occurs when the Fe is rendered passive by immersion in HNO_3. By heating for a short time in vac. the original smaller secondary emission is regained, and the passivity is removed. It is possible to use this method of investigating secondary emission to study the thickness, rate of growth, and structure of protective oxide films. A. J. M.

Secondary-electron emission from single crystals of copper, using small primary velocities. G. Bekow (*Physikal. Z.*, 1942, **41**, 144—145).—The secondary-electron yield of single crystals of Cu for primary electrons of different energies is investigated. The secondary emission is different from that for polycryst. Cu, and varies for the different faces. The highest yield is obtained from the (100) plane. A. J. M.

Change in the electric resistance of a single crystal of magnetite by magnetic field at low temperature. H. Masumoto and Y. Shirakawa (*Physical Rev.*, 1941, [ii], **60**, 835).—Measurements of change of resistance and intensity of magnetisation for the principal [111] axis at 0°, −95°, and −195° in longitudinal fields of 0—1200 oersteds are plotted. The change of resistance is negative for all field strengths at temp. $<0°$; at 0° and −95° it decreases at first rapidly and then slowly with increase of field; at −195° it decreases linearly, after the allotropic transformation at ~−158° to −166°. In transverse fields the change of resistance is similar to that in the ferromagnetic metals. N. M. B.

Electrical conductivity of zinc oxide. P. H. Miller, jun. (*Physical Rev.*, 1941, [ii], **60**, 890—895).—Measurements on average samples, having regard to O_2 pressure, temp., and ageing, show that the conductivity follows the equations $\sigma = 10^{-2}\exp(-2 \times 10^{-2}/kT)$ for $T < 25°$ and $\sigma = 10^{2}\exp(-7 \times 10^{-1}/kT)$ per Ω. per cm. for $400° < T < 700°$. The conductivity at $T < 25°$ is believed to be due to the ionisation of interstitial Zn atom pairs with ionisation energy $> 2 \times 10^{-2}$ v., and reaches saturation at approx. room temp. For 400—700° it increases and is due to the ionisation of single interstitial Zn atoms with ionisation energy 7×10^{-1} v., and reaches saturation at ~800°. Hall effect measurements show the free-electron density to be $\sim 10^{15}$ per c.c. at room temp. N. M. B.

Stability of crystal lattices. VII. Long-wave and short-wave stability for the face-centred cubic lattice. (Miss) S. C. Power. **VIII. Stability of rhombohedral Bravais lattices.** H. W. Peng and (Miss)

S. C. Power. **IX. Covariant theory of lattice deformations and the stability of some hexagonal lattices.** M. Born (*Proc. Camb. Phil. Soc.*, 1942, **38**, 61—66, 67—81, 82—99; cf. A., 1941, I, 198).—Mathematical. VII. It is proved, for the case of a face-centred cubic lattice in which the effects of all but the first 12 neighbours may be neglected, that a lattice stable with respect to macroscopic deformations, *i.e.*, elastic vibrations, will also be stable microscopically, *i.e.*, to thermal vibrations.

VIII. The stability of the rhombohedral Bravais lattice of arbitrary angle is investigated. It is shown that, of the three cubic Bravais lattices in the continuous series obtained by varying the rhombohedral angle, the simple cubic lattice corresponds with a max. and the face-centred and body-centred lattices with min. of potential energy. By numerical calculation of the characteristic curve it is shown that no other extrema exist and that the face-centred lattice corresponds with an abs. min. of potential energy.

IX. The theory of lattice deformations is presented in a new form using the tensor calculus. The case of central forces is investigated and results are applied to some simple hexagonal lattices. The Bravais hexagonal lattice is unstable but the close-packed hexagonal lattice is stable. The ratio of the elastic consts. of the latter is calc. and compared with experimental vals. for beryl, $Be_3Al_2(Si_6O_{18})$. O. D. S.

Elasticity of polycrystals with viscous grain boundaries. C. Zener (*Physical Rev.*, 1941, [ii], **60**, 906—908; cf. A., 1940, I, 353).—Mathematical. An investigation of the elastic properties of a specimen in which the grain boundaries are incapable of supporting shearing stresses shows that Young's modulus is 50—70% of its val. when no slip at grain boundaries occurs, depending on Poisson's ratio. This reduction should be observable by comparing vals. measured statically at high temp. with those measured dynamically. N. M. B.

Theory of plastic properties of solids. I. F. Seitz and T. A. Read (*J. Appl. Physics*, 1941, **12**, 100—118).—Theories of slip are considered, chiefly in connexion with single crystals. The theories of Becker and Smekal and the theory of dislocations are discussed. A. J. M.

Theory of plastic properties of solids. III. F. Seitz and T. A. Read (*J. Appl. Physics*, 1941, **12**, 470—486).—A review and discussion of creep, twinning, rupture, and fatigue phenomena in single-crystals, chiefly of metals. (For Part II see B., 1942, I, 161.) A. J. E. W.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Electrical conductivity of uranium oxides. K. Hauffe (*Z. physikal. Chem.*, 1941, **B**, **48**, 124—130).—The electrical conductivities of UO_2 and U_3O_8 in the temp. range 800—1000° under various pressures of O_2 have been determined. The conductivity is almost independent of pressure of O_2. If the variation of conductivity, χ, of U_3O_8 with temp. is represented by $\chi = \text{const.} \times e^{-\Delta E/RT}$, the energy increment ΔE is ~5 kg.-cal. A. J. M.

Increase in residual magnetism caused by a current flowing through an iron bar. H. A. Perkins and H. D. Doolittle (*Physical Rev.*, 1941, [ii], **60**, 811—817).—If a bar of high-grade wrought Fe or of permalloy is placed in a magnetic field and if this field is abruptly (but not if gradually) reduced to zero, a current set up in the metal causes an increase of the residual magnetism. The effect is not obtained if the current flows in a wire along the hollow axis of the Fe, unless the cylinder is slotted longitudinally. Magnetisation curves are given and discussed. Two effects seem to be involved: one results in decreasing the residual magnetism, and is apparently associated with the circular flux set up in the bar by the current through the bar or axial wire; the other, if it could be isolated, would probably produce only increases in residual magnetism, and seems to depend on an unstable condition of the magnet. N. M. B.

Gyromagnetic effects in ferromagnetic substances. C. J. Gorter (*Physical Rev.*, 1941, [ii], **60**, 836).—Revised lower vals. recently reported by Barnett for the deviations of the ratio of mechanical to magnetic moment from the spin-only val. are considered. Results fall into four groups: Ni and alloys, Co and alloys, Fe and alloys, and Heusler's alloy. Vals. calc. from the deviations of the susceptibilities of bivalent paramagnetic salts from the spin-only vals. show a parallelism, but deviations from unity are ~3 times the experimental ferromagnetic deviations. N. M. B.

Change in magnetic susceptibility of nickel disalicylaldehyde on hydrogenation. M. A. Fobes and G. N. Tyson, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3530).—When green Ni disalicylaldehyde is hydrogenated it becomes yellow-brown. Both compounds are paramagnetic and have two unpaired electrons. W. R. A.

Magnetic susceptibility of strontium. S. R. Rao and K. Savithri (*Current Sci.*, 1941, **10**, 363).—The mean val. of $\chi_{sp.}$ for Sr containing traces of Ca and Pb, determined by the Curie method at 3—8 kG., is $+1{\cdot}05 \times 10^{-6}$, giving $\chi_{at.} = +92{\cdot}0 \times 10^{-6}$. Since χ for $Sr^{\cdot\cdot}$ is $-15{\cdot}6 \times 10^{-6}$ (Kido, A., 1934, 14) the two valency electrons in Sr contribute $107{\cdot}6 \times 10^{-6}$ to the χ val.; the width of the occupied energy range in their completely degenerate state is ~0·6 v. A. J. E. W.

Temperature variation of sound velocity in liquids. G. Suryan (*Current Sci.*, 1941, **10**, 489).—The velocity of sound in a liquid is given by $v = Le^{S/T}$, where the consts. L and S depend on the mol. wt. and structure of the liquid. This relation is verified graphically for glycerol, H_2O, $COMe_2$, Et_2O, C_7H_{16}, C_6H_6, PhMe, and NH_2Ph. A. J. E. W.

Distribution of lattice vibrations of the potassium chloride crystal. M. Iona, jun. (*Physical Rev.*, 1941, [ii], **60**, 822—826).—The distribution of characteristic vibrations has been calc. by the Born–Kármán–Blackman method on the assumption of both electrostatic and repulsive forces between the ions. The latter forces are calc. for the 18 nearest neighbours from the elastic consts. and the residual-ray frequency. Full data are tabulated. The distribution is applied to the evaluation of the sp. heat at low temp. N. M. B.

Specific heat of α-quartz. B. D. Saksena (*Current Sci.*, 1941, **10**, 484).—Vals. of the sp. heat at 50—273° K., derived from Anderson's data (cf. A., 1936, 673), are in agreement with the author's calc. vals. (cf. A., 1940, I, 402). A. J. E. W.

Specific heat of calcium carbide at low temperatures. K. K. Kelley (*Ind. Eng. Chem.*, 1941, **33**, 1314—1315).—The sp. heat of CaC_2 (91%) has been determined at 51—298° K. and corrections for the impurities present are applied to the results. The entropy of CaC_2 at 298·16° K. is calc. as $16{\cdot}8 \pm 0{\cdot}5$ entropy units per g.-mol. and the free energy of its formation from Ca and graphite −15,300 g.-cal. per g.-mol. J. W. S.

Nitromethane: heat capacity of the gas, vapour density, and barrier to internal rotation. K. S. Pitzer and W. D. Gwinn (*J. Amer. Chem. Soc.*, 1941, **63**, 3313—3316).—C_p for gaseous $MeNO_2$ has been measured from 340° to 450° K. at from 0·11 to 1·0 atm. The vapour density has been measured from 380° to 425°. The heat of vaporisation at the b.p. is 8225 ± 25 g.-cal. per mol. The second virial coeff., the heat capacity of the perfect gas, the barrier to internal rotation (800 g.-cal.), and the entropy ($S^{\circ}_{298{\cdot}1} = 65{\cdot}64 \pm 0{\cdot}15$ g.-cal. per degree per mol.) have been calc. W. R. A.

Heat capacity, entropy, and heats of transition, fusion, and vaporisation of dimethylacetylene. Free rotation in the dimethylacetylene molecule. D. M. Yost, D. W. Osborne, and C. S. Garner (*J. Amer. Chem. Soc.*, 1941, **63**, 3492—3496).—C_p vals. for C_2Me_2 have been obtained from 14·7° to 284·3° K. The m.p. is $240{\cdot}93 \pm 0{\cdot}05$° K., and the heat of fusion 2207 ± 2 and of vaporisation 6440 ± 6 g.-cal. per mol. at 291·00° K. and 536 mm. The entropy of the ideal gas from C_p measurements is $67{\cdot}48 \pm 0{\cdot}20$ g.-cal. per degree per mol. at 1 atm. and 291·00° K. and 67·93 at 1 atm. and 298·16° K. The entropy of the liquid is $46{\cdot}63 \pm 0{\cdot}1$ g.-cal. per degree per mol. The difference between the statistical and calorimetric entropies indicates that the barrier restricting rotation of the Me groups is > 500 g.-cal. per mol. W. R. A.

Heat capacity, entropy, heats of fusion and vaporisation, and vapour pressure of trichlorofluoromethane. D. W. Osborne, C. S. Garner, R. N. Doescher, and D. M. Yost (*J. Amer. Chem. Soc.*, 1941, **63**, 3496—3499).—C_p vals. for CCl_3F have been obtained from 14·74° to 287·82° K. The m.p. is $162{\cdot}68 \pm 0{\cdot}05$° K.; heats of fusion and vaporisation are 1648 ± 2 and 6025 ± 6 g.-cal. per mol. The v.p. is given by $\log p$ (int. mm. Hg) $= 18{\cdot}54101 - 1841{\cdot}72/T - 3{\cdot}82423 \log T$ in the range 236—293° K., giving the b.p. as 296·82°. The entropy of the ideal gas from calorimetric data is $74{\cdot}07 \pm 0{\cdot}1$ g.-cal. per degree per mol. at 298·16° K., within 0·02 unit of the val. from mol. data. The entropy of the liquid is $53{\cdot}92 \pm 0{\cdot}1$ g.-cal. per degree per mol. at 298·16° K. and 1 atm. W. R. A.

Heat capacity, entropy, heats of fusion, transition, and vaporisation, and vapour pressures of methyl mercaptan. H. Russell, jun., D. W. Osborne, and D. M. Yost (*J. Amer. Chem. Soc.*, 1942, **64**, 165—169). —C_p vals. for MeSH from 14·97° to 279·12° K. (b.p.) have been measured and show that there is a slow isothermal transition at $137{\cdot}6 \pm 0{\cdot}1$ K. with a heat of transition of $52{\cdot}5 \pm 0{\cdot}5$ g.-cal. per mol. The m.p. is $150{\cdot}16 \pm 0{\cdot}02$° K.; heats of fusion and vaporisation are $1411{\cdot}4 \pm 2{\cdot}0$ and 5872 ± 4 g.-cal. per mol. In the range 222—279° K. the v.p. is represented by $\log_{10} p_{(\text{mm.})} = 18{\cdot}2749 - 1769{\cdot}05/T - 3{\cdot}70248 \log_{10} T$. The entropy of the ideal gas at 1 atm. and b.p. is $60{\cdot}16 \pm 0{\cdot}10$ g.-cal. per degree per mol. The barrier restricting rotation of the Me group is 1460 ± 270 g.-cal. per mol. W. R. A.

Heat capacity, heats of fusion and vaporisation, vapour pressure, and entropy of dimethyl sulphide. D. W. Osborne, R. N. Doescher, and D. M. Yost (*J. Amer. Chem. Soc.*, 1942, **64**, 169—172).—Vals. for C_p of Me_2S from 14·08° to 286·69° K. have been measured. The m.p. is $174{\cdot}86 \pm 0{\cdot}02$° K., the heat of fusion is $1908{\cdot}4 \pm 1$ and of vaporisation 6688 ± 7 g.-cal. per mol. For the range 250·6—290·2° K. v.p. is represented by $\log_{10} p_{(\text{mm.})} = 16{\cdot}51798 - 1876{\cdot}370/T - 3{\cdot}04727 \log_{10} T$. The entropies at 298·16° K. are $68{\cdot}28 \pm 0{\cdot}1$ for the ideal gas and $46{\cdot}94 \pm 0{\cdot}07$ g.-cal. per degree per mol. for the liquid. The statistical entropy exceeds the calorimetrical val. by an amount corresponding with a barrier potential of 2000 g.-cal. per mol. hindering the rotation of each Me. W. R. A.

Heat capacity of gaseous ββδ-trimethylpentane. M. Kiperash and G. S. Parks (*J. Amer. Chem. Soc.*, 1942, **64**, 179).—C_p vals. for gaseous $CH_2Pr^{\beta}Bu^{\gamma}$ for the range 442—458° K. are given and compared with those calc. from Pitzer's equation (A., 1941, I, 458). W. R. A.

Regularities in the clear and transition points in homologous series of liquid-crystalline substances. II. Chemical morphology of liquids. C. Weygand and R. Gabler (*Z. physikal. Chem.*, 1941, **B, 48**, 148—153).—Some characteristics of the fixed temp. of homologous series of liquid-cryst. substances are discussed. A. J. M.

Is sharpness of melting influenced by isotopes? Triple-point pressures of carbon monoxide, argon, nitrous oxide, hydrogen chloride, and hydrogen bromide. K. Clusius [with L. Staveley] (*Z. physikal. Chem.*, 1941, **B, 49**, 1—12).—Sharpness of melting is defined as $T/\Delta T$, where T is m.p. and ΔT the lowering of f.p. or, in formation of mixed crystals, the interval of melting. Isotopes have no effect on sharpness of melting. Triple-point pressures are given for CO, A, N_2O, HCl, and HBr. W. R. A.

Retrograde transition of ND_4Br. II. Piezo-electric studies. A. Smits and P. G. Meerman (*Z. physikal. Chem.*, 1941, **B, 49**, 13—20).—Neither form of ND_4Br exhibits piezo-electric behaviour from room temp. to liquid air temp. This is interpreted on the theory of equilibrium of the two modifications. W. R. A.

Thermodynamic properties of nitrogen at high pressures as analytic functions of temperature and pressure. S. H. Maron and D. Turnbull (*J. Amer. Chem. Soc.*, 1942, **64**, 44—47).—An equation of state for N_2, which reproduces the P–V–T behaviour from −70° to 600° and for pressures up to 1000 atm. has been developed. Analytic functions of P and T for activity coeffs., heats, entropies, heat capacities of compression, and the Joule–Thomson coeffs. have been deduced from the equation. Results are compared with those of Deming and Shupe (A., 1931, 553). W. R. A.

Densities of aliphatic amines. E. Swift, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 115—116).—Vals. of ρ at 0°, 15°, 25°, and 35° have been measured for $NHMe_2$, NMe_3, NH_2Et, $NHEt_2$, and NEt_3 and fit the equation $\rho\theta = \rho\theta_1 + 10^{-3} \cdot \alpha(\theta - \theta_1) + 10^{-6} \cdot \beta(\theta - \theta_1)^2$. α and β have been evaluated. W. R. A.

***p*-Cymene. VI. Vapour pressure of *p*-cymene, some of its derivatives, and related compounds.** K. A. Kobe, T. S. Okabe, M. T. Ramstad, and P. M. Huemmer (*J. Amer. Chem. Soc.*, 1941, **63**, 3251—3252).—V.p. equations are given for *p*-cymene and 16 derivatives and closely related compounds: cumene, 2- and 3-nitro-, 2- and 3-hydroxy-, 2- and 3-chloro-, 2- and 3-bromo-*p*-cymene, *p*-$C_6H_4Me{\cdot}COMe$, *p*-$C_6H_4Me{\cdot}NO_2$, *p*-$C_6H_4Me{\cdot}NH_2$, carvone, fenchone, *iso*pulegol, menthol. W. R. A.

Vapour of propionic acid at 45°, 50°, 55°, 60°, and 65°. F. H. MacDougall (*J. Amer. Chem. Soc.*, 1941, **63**, 3420—3424).—Vals. for pV of the vapour of $EtCO_2H$ have been determined at 5° intervals from 45° to 65° and pressures of 3—20 mm. The vapour is associated to dimerides and higher polymerides and equilibrium consts. for the association reactions have been determined. Heats of formation of di- and tri-merides yield a val. of 9±1 kg.-cal. for the "strength" of the H-bond. W. R. A.

Vapour pressure curve. K. Fuchs (*Proc. Roy. Soc.*, 1941, **A, 179**, 194—201).—Exact equations are derived for the v.p. and condensation vol. of the gas in terms of the virial coeffs. and the free energy of the condensed phase. The formula for the v.p. reduces to that of Stern as a first approximation. G. D. P.

Spark patterns of the elements. W. Baukloh (*Arch. Eisenhüttenw.*, 1940, **13**, 543—547; *Bull. Iron Steel Inst.*, 1941, No. 70, 224A).—The ability of 39 elements to form sparks when ground with an alundum wheel was studied. The spark-forming elements belong mainly to the first sub-groups of the three long periods of the periodic system. No direct relation exists between either the hardness or the heat of combustion and the ability to form sparks. A sufficiently high heat of combustion is a necessary condition for spark formation, and the nature of the pattern depends on the combustion process and the constitution of the liquid or solid products of combustion. The occurrence of minute explosions (seen as small stars) is caused by either the formation of gaseous products of combustion or the vaporising of the metal. The process of spark-pattern formation is a result of a complicated heterogeneous decomp. R. B. C.

Low-temperature properties of gaseous helium. II. R. A. Buckingham, J. Hamilton, and H. S. W. Massey (*Proc. Roy. Soc.*, 1941, **A, 179**, 103—122).—Earlier calculations are extended (cf. A., 1939, I, 135, 191). The second virial coeff. is calc., using exact quantum formulæ, for several different forms of interat. potential, and the theoretical results are compared with experimental. A similar treatment of the viscosity coeff. leads to contradictory results but the observational data are too few to prove that the theory is at fault. G. D. P.

Frictional phenomena. II. A. Gases. A. Gemant (*J. Appl. Physics*, 1941, **12**, 626—633; cf. A., 1942, I, 51).—An explanation of the viscous forces within a gas, and the frictional forces between a gas and a wall, is given on the basis of the kinetic theory. Comparison of experimental results with theory shows, in general, satisfactory agreement. The importance of the theory of slip in connexion with experimental determinations of η is emphasised. A. J. M.

Frictional phenomena. III. Absorption of sound waves and supersonics. IV. Sound-absorbing materials. V. B. Liquids; theory and experimental facts. A. Gemant (*J. Appl. Physics*, 1941, **12**, 718—724, 725—734, 827—836; cf. preceding abstract).—III. The effect of viscosity on absorption of freely-propagated acoustic waves in gases is examined theoretically. A large divergence between calc. and experimental absorption coeff. vals. for air, A, CO_2, and O_2 is attributed to intramol. vibration effects.

IV. The sound-absorbing properties of porous materials are discussed in relation to gas viscosity effects in the pores. The "radiation resistance" of an absorbent is largely determined by its resistance to gas flow, the measurement of which is discussed. The optimum structural characteristics of an ideal absorbent are determined.

V. Theories of liquid viscosity, particularly that of Eyring, are discussed, and the effects of constitution, temp., pressure, and mixture composition are illustrated by reference to previous data. The incidence and character of turbulent flow are briefly discussed. A. J. E. W.

Viscosity of ethylene and of carbon dioxide under pressure. E. W. Comings and R. S. Egly (*Ind. Eng. Chem.*, 1941, **33**, 1224—1229). —The viscosities (η) of C_2H_4 and of CO_2 at 40°/4·4—137·1 atm. have been determined by observation of the rate of passage of the gas through a capillary tube under the pressure exerted by a Hg pellet. At pressures < the crit. pressure η for C_2H_4 increases less rapidly with increasing pressure than is predicted theoretically, but at higher pressures the observed vals. increase more rapidly with increasing pressure and are > the theoretical vals. J. W. S.

Determination of diffusion coefficients.—See A., 1942, I, 90.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Compressibilities of gaseous mixtures of methane and *n*-butane. Equation of state for gas mixtures. J. A. Beattie, W. H. Stockmayer, and H. G. Ingersoll (*J. Chem. Physics*, 1941, **9**, 871—874).—The compressibilities of three gaseous mixtures of CH_4 and *n*-C_4H_{10} have been measured from 100° to 300° and from 1·25 to 10 mol. per l. (max. pressure 350 atm.). These data and data on CH_4 and *n*-C_4H_{10} are used to study several methods of combination of consts. in the Beattie–Bridgeman equation of state extended to gas mixtures. W. R. A.

Second virial coefficients of polar gas mixtures. W. H. Stockmayer (*J. Chem. Physics*, 1941, **9**, 863—870).—The empirical equation used by Keyes for the second virial coeff. of polar gases is compared with a theoretical expression (A., 1941, I, 293), and consts. in the latter are discussed in terms of intermol. forces and in relation to consts. in the Beattie–Bridgeman equation for non-polar gases. Rules are given for the calculation of the second virial coeffs. of any gas mixture if the second virial coeffs. and dipole moments of its components are known. These rules are successfully applied to H_2O–CO_2, N_2–NH_3, and N_2–H_2O mixtures, except that, at higher temp., the N_2–H_2O mixtures exhibit discrepancies which are only partly counteracted by inclusion of higher virial coeffs. W. R. A.

Velocity of diffusion in a mixed gas; second approximation. S. Chapman and T. G. Cowling (*Proc. Roy. Soc.*, 1941, **A, 179**, 159—169).—The general equation of diffusion in a mixed gas in non-uniform motion, in the presence of forces imparting differential accelerations to the two constituents, and of gradients of composition, pressure, and temp., has been carried to a second approximation. This adds nine new terms to the expression for the velocity of diffusion, and each new term involves a new "second-order" diffusion coeff. All the new terms depend on the gradients of the mean motion of the gas and vanish if this is uniform. The expressions for the nine new diffusion coeffs. are very complicated and are evaluated only approx. With one exception they are of negligible magnitude compared with the first-order terms in the velocity of diffusion. G. D. P.

Viscosity of formamide–dioxan solutions at 5°, 25°, and 40°. W. G. Parks, I. M. LeBaron, and E. W. Molloy (*J. Amer. Chem. Soc.*, 1941, **63**, 3331—3336).—Measurements of η and ρ for $HCO{\cdot}NH_2$ (I)–dioxan solutions (0—100 wt.-%) at 5°, 25°, and 40° are compared with those for (I) solutions of AcOH, EtOH, and H_2O. Mathematical equations have been derived for the variation of ρ with temp. for both compounds, and for the relationships between the composition of the solution and its ρ and η. η increases with increasing concn. of (I) to a max. at 91 wt. %, indicating the formation of the compound $C_4H_8O_2{,}5HCO{\cdot}NH_2$. On mixing the change in vol. is negligible. W. R. A.

Region of critical solution of binary liquids; evidence for an anomalous first-order transition in the system triethylamine–water.

L. D. Roberts and J. E. Mayer (*J. Chem. Physics*, 1941, **9**, 852—858).—The change of fugacity with composition of the system NEt_3–H_2O near the crit. solution temp. (θ_c) is zero for at least 5° on the one-phase side and for compositions of liquid between 20 and 50 wt.-%. This is interpreted as evidence for the existence of a range of anomalous first-order transition near θ_c. W. R. A.

Specific gravity of sodium dichromate solutions. D. F. Altimier (*J. Amer. Chem. Soc.*, 1942, **64**, 175—176).—Vals. of sp. gr. (15·6°/15·6°) for aq. $Na_2Cr_2O_7$ (1·50—63·92 wt.-%) are given. W. R. A.

Compressibility of solutions of uni-univalent electrolytes. B. Lundén (*Svensk Kem. Tidskr.*, 1941, **53**, 86—96).—κ for aq. solutions (0·02—1·25M.) of the salts (Li, Na, K, Rb, Cs, NH_4)(F, Cl, Br, I, NO_3, ClO_3, ClO_4) has been measured by the standing supersonic wave method. Vals. are given for $\phi(\bar{\kappa}) = (\kappa V - \kappa_{H_2O} V_{H_2O})/n$, the apparent molar compressibility, involving the determination of d for several of the salts. $\phi(\bar{\kappa})$ varies inversely with $\sqrt{c}$, and vals. for $\phi(\bar{\kappa}_0)$ are extrapolated. The ionic vals. of $\phi(\bar{\kappa}_0)$ are additive, $Na^{\cdot} > K^{\cdot} > Rb^{\cdot} > Li^{\cdot} > Cs^{\cdot} \gg NH_4^{\cdot}$, and $F' \gg Cl' > Br' > ClO_3' > NO_3' \gg ClO_4' > I'$ in agreement with theory except for $Li^{\cdot}$ and $NH_4^{\cdot}$. Vals. for the slope of the $\phi(\bar{\kappa})$–$\sqrt{c}$ line are ~6·0, in agreement with Debye's theory, but fluorides are high (~16) and NH_4 salts low. $\phi(\bar{\kappa})$ for NH_4ClO_4 varies directly with $\sqrt{c}$, with a slope of −1·8. M. H. M. A.

Line co-ordinate chart for vapour pressures of saturated aqueous solutions. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 1278).—A chart which permits calculation of the v.p. of saturated aq. solutions of Na_2SO_4, K_2SO_4, NaCl, KCl, and CsCl at 0—27° is given. J. W. S.

Modification of cupric chloride crystallisation patterns by traces of protein.—See A., 1942, III, 264.

Rates and mechanism of phase changes in binary mixtures of alkali halides. F. A. Matsen and J. Y. Beach (*J. Amer. Chem. Soc.*, 1941, **63**, 3470—3473).—By means of *X*-ray powder photographs the rates and mechanisms of formation of solid solutions in equimol. mixtures of KCl–KBr, NaCl–NaBr, and NaCl–KCl have been investigated at various temp., and the rate of decomp. of the solid solution of NaCl–KCl has been qualitatively observed. The prep. of a solid solution of NaCl–KCl is discussed. W. R. A.

***X*-Ray study of binary alloys of platinum with cobalt, molybdenum, and tungsten.** R. Hultgren and R. I. Jaffee (*J. Appl. Physics*, 1941, **12**, 501—502).—The high magnetic remanence and coercivity of an alloy of the composition PtCo (cf. Jellinghaus, *Z. tech. Physik*, 1936, **17**, 33) are due to the formation of a tetragonal superlattice (a_0 3·818, c_0 3·639 A., c_0/a_0 0·953) with an AuCu structure; this is stable at 600°, but gives a face-centred cubic disordered phase (a_0 3·761 A.) at 1000°. A body-centred cubic phase (a_0 2·87 A.) is formed at 400°. At 1000° Pt forms solid solutions containing >50 at.-% of Mo or 35 at.-% of W; these have face-centred cubic structures with parameters approx. equal to that for Pt. A. J. E. W.

Passivity of iron in strongly alkaline solutions, studied with the help of organic reagents for metals. G. Nilsson (*Svensk Kem. Tidskr.*, 1941, **53**, 81—86).—Alkaline solutions of $(CS{\cdot}NH_2)_2$ attack soft Fe giving a bright blue complex ion, and may be used for passivity studies. NHPh·CS·CS·NH_2, NH_2·C(:NH)·NH·NO, and CN·C(:N·OH)·CO·NH_2 are also suitable. M. H. M. A.

Interaction of ions and dipolar ions. III. Solubility of thallous salts in glycine and in alanine solutions. R. M. Keefer and H. G. Reiber (*J. Amer. Chem. Soc.*, 1941, **63**, 3504—3507).—The solubilities of TlBr in solutions of KNO_3, glycine, alanine, and glycine + KNO_3 and of $TlIO_3$ in glycine and in alanine solutions have been determined. TlBr shows normal behaviour in respect to the limiting law (cf. A., 1941, I, 264), but $TlIO_3$ shows some irregularities. W. R. A.

Solubility of strychnine acid sulphate in sulphuric acid. B. M. G. Zwicker and R. J. Robinson (*J. Amer. Chem. Soc.*, 1941, **63**, 3538).—The solubility of strychnine H sulphate in H_2SO_4 (19·4—59·7 wt.-%) has been determined at 20°. The solubility curve passes through a min. at ~28·5 wt.-% of H_2SO_4 where the solubility is 0·029 g. per 100 g. of aq. H_2SO_4. W. R. A.

Partition ratios of some organic acids between water and ethyl ether. O. C. Dermer, W. G. Markham, and H. M. Trimble (*J. Amer. Chem. Soc.*, 1941, **63**, 3524—3525).—The distribution between H_2O and Et_2O has been measured at 25° for HCO_2H, $CH_2Cl{\cdot}CO_2H$, $CHCl_2{\cdot}CO_2H$, $CCl_2{\cdot}CO_2H$, $CH_2Br{\cdot}CO_2H$, $OH{\cdot}CH_2{\cdot}CO_2H$, glycine, $OH{\cdot}CMe_2{\cdot}CO_2H$, $PhSO_3H$, acrylic, adipic, barbituric, crotonic, furoic, succinic, and tartaric acids. A tenfold range of concn. was studied and only $OH{\cdot}CH_2{\cdot}CO_2H$ gives a const. partition ratio. The other acids give mostly a ratio which decreases as concn. increases, but glycine, tartaric acid, and $PhSO_3H$ give ratios which increase with increasing concn. W. R. A.

Adsorption isotherms of synthetic resin ion-exchange adsorbents. R. J. Myers, J. W. Eastes, and D. Urquhart (*Ind. Eng. Chem.*, 1941, **33**, 1270—1275).—Cationic and anionic exchange by synthetic resins, although involving chemical reaction, are controlled by diffusion and reaction velocity factors to such an extent thatthey can be considered as a type of chromatographic adsorption. The capacity of columns of the resins prior to the appearance of the exchanging ion in the effluent H_2O (" break-through capacities ") is correlated with Freundlich adsorption isotherms determined under conditions simulating those in the columns. It is shown that adsorption methods can be used for the rapid evaluation of resins. The preferential adsorption phenomena with synthetic resins is in some cases observable visually through chromatographic banding. J. W. S.

Surface tension of solutions of electrolytes as a function of concentration. III. Sodium chloride. G. Jones and W. A. Ray (*J. Amer. Chem. Soc.*, 1941, **63**, 3262—3263; cf. A., 1941, I, 165).—Vals. of relative γ for aq. NaCl (0·0001—2·00M.) have been measured at 25°. The γ-concn. curve shows a min. for extremely dil. solutions, indicating that NaCl behaves as a capillary-active substance, whereas at moderate and high concn. NaCl acts like a typical capillary-inactive salt. W. R. A.

Supermolecule formation at interfaces. H. Dunken, I. Fredenhagen, and K. L. Wolf (*Kolloid-Z.*, 1941, **95**, 186—188).—The interfacial tension–concn. curves for solutions of $BuCO_2H$ in C_7H_{16} and in *cyclo*hexane (but not in C_6H_6) show a very sharp min. at a mol. fraction ~10^{-4}. This is attributed to the existence at very low concns. of single mols. of the acid, which are assumed to exert a higher surface activity than double mols. F. L. U.

Immobile layer at the solid–liquid interface. J. J. Bikerman (*J. Chem. Physics*, 1941, **9**, 880).—Polemical against Eversole and Lahr (A., 1941, I, 413). W. R. A.

Surface chemistry of carotenoids. I. Astacene. J. F. Danielli and D. L. Fox (*Biochem. J.*, 1941, **35**, 1388—1395).—A solution of astacene in light petroleum (yellow) turns pink on emulsification with H_2O, irrespective of p_H or salt concn. This phenomenon is not due to increased ionisation at the interface. The chief cause is probably the fact that the interface is a different solvent, since other non-ionising and non-enolising carotenoids show a similar phenomenon on adsorption. The interface behaves as a more polar solvent than light petroleum, but enolisation may be a contributory cause with astacene. P. G. M.

Composition of the ultrafiltrate obtained from electrolytes and sols by the sieve action of collodion membranes. W. Hacker (*Kolloid-Z.*, 1941, **95**, 194—206; cf. A., 1942, I, 96).—Equations are derived for calculating the sp. conductance (κ) of the ultrafiltrate from an electrolyte solution at different stages. Vals. calc. on the limiting assumptions of (*a*) complete absence of mixing and (*b*) complete mixing at the exit surface of the membrane differ only for the initial stages. Vals. calc. for HCl and NaCl solutions agree well with experiment. In the ultrafiltration of sols the Donnan effect is superposed on the sieve action and plays an increasingly important part as the vol. of liquid on the filter decreases. Methods of calculating κ of the micellar constituent of the sol from observations on the ultrafiltrate are discussed. F. L. U.

Osmotic pressure and membrane action. A. Thiel (*Kolloid-Z.*, 1941, **94**, 348—349).—Reply to Metcalf (A., 1942, I, 90). F. L. U.

Hydrogel of zirconia. I. Time of set. C. B. Hurd, W. A. Fallon, and R. W. Hobday (*J. Amer. Chem. Soc.*, 1942, **64**, 110—114)—The time of set (t) of hydrogels of ZrO_2, prepared by mixing solutions of Na_2CO_3 and NaOAc with $ZrOCl_2$, has been studied in terms of temp., p_H, and concn. of added electrolyte, KCl. On mixing the solutions, an increase of p_H from 0·1 to 2—5 was observed. The energy of activation varied from 21,000 to 29,000 g.-cal. The gels are softer than silicic acid gels, but do not hold their form. Quick-setting gels formed by using NaOAc at 25° often reliquefied in a few hr. On raising the temp. to 60° re-gelation occurred but, on cooling, the gel liquefied again. t is decreased greatly by KCl in low concn. A theory of setting, which involves condensation of $ZrO(OH)_2$, is advanced on the assumption that $ZrO(OH)_2$ is amphoteric. W. R. A.

Colloid chemistry of system soaps–cresol–water. VI. Viscosity of sodium and potassium stearate solutions in presence of phenols. E. Angelescu and T. Manolescu (*Kolloid-Z.*, 1941, **94**, 319—327; cf. A., 1940, I, 254).—The η of 0·2N-Na and -K stearate solutions in presence of various phenols has been measured at 50—80°. In all cases the max. observed at a certain phenol concn. becomes less marked with rise of temp. Compared with the max. produced by the cresols, it is depressed by those phenols which are more sol. than the cresols in H_2O, and accentuated by those which are more sol. in hydrocarbons. Of the substances studied, PhOH, *o*- and *m*-$C_6H_4(OH)_2$, *o*- and *m*-$NO_2{\cdot}C_6H_4{\cdot}OH$, *p*-$NH_2{\cdot}C_6H_4{\cdot}OH$, *α*- and *β*-$C_{10}H_7{\cdot}OH$, the last-named give rise to the sharpest max., and $C_6H_4(OH)_2$ abolishes it completely. The results are interpreted in terms of external and internal solvation. F. L. U.

Determination of polydispersity from diffusion measurements by Lamm's scale method. N. Gralén (*Kolloid-Z.*, 1941, **95**, 188—194).—Formulæ are derived for calculating the polydispersity of a solute from the refractometric data obtained by Lamm's method and examples of their application are given. Diffusion measurements

are specially suitable for determining the polydispersity of long-chain mols. F. L. U.

Molecular orientation and some associated properties in macromolecular substances with filamentous and reticular structures. I. F. H. Müller (*Kolloid-Z.*, 1941, **95**, 138—181).—The substances considered are branched or unbranched linear mols. that do not tend spontaneously to form crystallites or micelles. The behaviour of such mols. under mechanical deformation is determined by the effect of the applied forces on the orientation of the individual monomeric units. The various types of orientation are classified and its effects on mechanical, optical, and thermal properties are illustrated, chiefly from data relating to polystyrene. The subject is treated theoretically by the use of an orientation distribution function which defines the mean orientation of the monomeric units. F. L. U.

Macromolecular properties of linear polyesters. Viscous flow and kinetic interaction in solution of ω-hydroxyundecoic self-polyesters. W. O. Baker, C. S. Fuller, and J. H. Heiss, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3316—3321).—The concn. (c) dependence of the solution viscosity (η_r) of several ω-hydroxyundecoic self-polyesters of known average chain length has been studied at 25° in $CHCl_3$, and related to the wt.-average mol. wt. (M_W) by $\log_e \eta_r/c = K_W M_W + B$, where K_W and B are consts. With increasing c and chain length an extra flow mechanism of chain articulation is introduced. Measurements with mixed polyesters show that M_W must be used for viscosity studies on inhomogeneous polymerides. K_W is independent of mol. wt. down to $M_W = 5000$. B has similar vals. for several of the polymerides provided that the chain length exceeds a min. val., and is probably connected with chain kinking. Flow orientation in conc. solutions has been studied by varying the shearing stress. η_r appears to exhibit a melt-like mechanism over a wide range of c. W. R. A.

Viscosity relations in concentrated solutions of synthetic resins from aniline and formaldehyde. W. Scheele, L. Steinke, and I. Avisiers (*Kolloid-Z.*, 1941, **94**, 294—310; cf. *ibid.*, 1940, **93**, 1).—Viscosities (η) of cresol solutions of NH_2Ph–CH_2O resins have been determined at concns. up to 30% and over the temp. range 40—90°, and the results are given in tables and diagrams. For the more conc. solutions η cannot be expressed by Arrhenius' formula or by the simple 6th-power formula of Bredée and de Booys (cf. A., 1937, I, 303), but if the correction term for the latter is introduced vals. of the " extension factor " are obtained which indicate that the particles in these solutions should be represented as only slightly elongated ellipsoids rather than as long chains. There is a linear relation between $\log(1/\eta_{rel.})$ and $1/T$. F. L. U.

Colloid-chemical properties of humus. Disperse chemistry of lignin. E. Junker (*Kolloid-Z.*, 1941, **95**, 213—250).—Lignin (I) is prepared from spruce sawdust, previously extracted with EtOH–C_6H_6, by extraction at 95° with dioxan containing 0·5% of conc. HCl, in which (I) dissolves and can be separated, after removing most of the solvent, by addition of H_2O. The crude product is boiled with 4% aq. H_2SO_4 to hydrolyse impurities and the residual (I) is electrodialysed. The product contains no N, and the C, H, and OMe contents vary with the % of HCl used for the extraction, suggesting that (I) is a complex mixture of chemically similar compounds. (I) can be dispersed in HCO_2H, AcOH, AcBr, PhCHO, CH_2Ph·OH, C_5H_5N, and aq. NaOH. Adsorption isotherms for H_2O vapour are given; they indicate that (I) is less hydrophilic than casein, Li-permutit, or H-kaolinite. Potentiometric and conductometric titrations with NaOH indicate 2·6 m-equiv. of exchangeable H per g. of (I). The base-exchange capacity under the most favourable conditions of dispersion is 2·5—2·8 m-equiv. per g., but this is reached only at p_H vals. considerably > those found in soils. (I) sols absorb O_2 from the air to the extent of 3·14 m-equiv. of O per g. in pure H_2O, increased in presence of NaOH to 7·6 m-equiv. for 0·14N-NaOH. Finely dispersed $CaCO_3$ increases, and $Mn(OH)_2$ and $Fe(OH)_2$ diminish, the absorption of O_2. Oxidised (I) is more easily dispersible than (I) and its exchangeable H is increased to 4·25 m-equiv. per g. The dispersibility of (I) in dil. NaOH is related to the presence of phenolic OH, fully acetylated (I) being non-dispersible. Coagulation vals. of cations for (I) sols are recorded; the vals. agree in order of magnitude with those for clay sols. F. L. U.

Hydrocolloidal cellulose and cellulose hydrosols. R. Haller (*Kolloid-Z.*, 1941, **94**, 310—312).—When cellulose (I) (bleached linters) is treated with conc. aq. NaOCl (d 1·21) and then heated on a water-bath vigorous action occurs, CO_2 and H_2O are evolved, and the product forms a white powder weighing ~55% of the original (I). The residue on washing with H_2O forms a stable hydrosol, coagulated by electrolysis, and showing all the properties of (I). Fehling's solution is not reduced, and no oxycellulose can be detected. No particles are visible in the ultramicroscope until electrolyte is added. Addition of Diamine-blue 3R and a little NaCl produces a red coagulum, whilst under the same conditions massive (I) is dyed blue. It is considered that the NaOCl breaks up part of the (I) completely while leaving the rest unaffected, since no intermediate oxidation products can be detected. F. L. U.

Dependence of viscosity on concentration in cellulose acetate. M. Takei and H. Erbring (*Kolloid-Z.*, 1941, **95**, 207—211).—The η of solutions of cellulose acetate in $CHCl_2$·CO_2H, NH_2Ph, Ac_2O, OH·CHMe·CO_2Et, OH·CHMe·CH_2·OAc, and $COMe_2$ was measured at concns. up to 12% and the vals. are compared with those calc. from the formulæ of Arrhenius (1), Bredée and de Booys (2), and Philippoff and Hess (3). (1) is unsatisfactory for all the solvents, whilst (2) gives good results for all, the val. of the const. A varying with the solvent from 2·73 to 3·25. (3) gives satisfactory vals. for those solvents for which A in the preceding formula is <3, but not for those for which A is >3. A correction term for (3) is proposed, the effect of which is to make the formula applicable to all the solutions. F. L. U.

Dielectric investigations with cellulose acetate in various solvents. M. Takei and H. Erbring (*Kolloid-Z.*, 1941, **94**, 312—318).—The d and n of solutions of cellulose acetate (OAc 53·2%) (I) in Et lactate (II), Ac_2O (III), $CHCl_2$·CO_2H (IV), $COMe_2$, OH·CHMe·CH_2·OAc, and NH_2Ph change linearly with the wt.-concn. of (I) up to the highest concn. (~12%) studied. Extrapolation to 100% of (I) gives d^{20} 1·301 and n^{20} 1·485. The sp. polarisation of (I) is independent of concn. in (II) and (III), shows a slight max. in (IV), and falls slightly with increasing concn. in the remaining solvents. The mean val. of the dipole moment of (I) is 2·11 D. The solvation calc. from the loss of polarisation in the various solvents amounts to 0·29—0·90 g. of solvent for 1 g. of (I). F. L. U.

Properties of carboxymethylcellulose and its salts.—See B., 1942, II, 10.

Rigidity and moisture hysteresis in gels. W. W. Barkas (*Nature*, 1941, **148**, 629—630).—Hysteresis in a gel is interpreted in terms of its elastic properties. L. S. T.

VI.—KINETIC THEORY. THERMODYNAMICS.

Isomerisation equilibrium among the branched-chain pentenes. R. H. Ewell and P. E. Hardy (*J. Amer. Chem. Soc.*, 1941, **63**, 3460—3465).—Pure pentene isomerides were isomerised by pumping their vapours over solid catalysts at const. temp. The isomerides formed were separated by fractional distillation. Equilibrium consts. have been calc. for the reactions CH_2:$CMeEt$ (I) = CMe_2:$CHMe$ (II), CH_2:$CHPr^\beta$ (III) = (II), and (III) = (I), and these data with calc. heats of isomerisation yield vals. for the entropy differences between the pairs of $-0·64 \pm 0·05$, $0·8 \pm 0·1$, and $1·4 \pm 0·2$ entropy units, respectively. W. R. A.

Vapour-phase esterification equilibrium. J. O. Halford and D. Brundage (*J. Amer. Chem. Soc.*, 1942, **64**, 36—40).—The equilibrium const. (K) for the esterification of AcOH by EtOH has been determined at 40—100° for dil. solutions of AcOH and EtOAc in a solvent containing 1·2237 mols. of H_2O per mol. of EtOH. The result at 40° has been converted into the vapour-phase const. For vapour-phase esterification $K(g)_{313°}$ is 122 ± 3, $\Delta G^0_{313°}$ is -2990 g.-cal. per mol., and $\Delta G^0 = -3970 \pm 3·1T$. W. R. A.

Calculation of equilibria in dilute water solutions. D. S. McKinney (*Proc. Amer. Soc. Test. Mat.*, 1939, **39**, 1191—1203).—The method of calculating the equilibrium concns. of the constituents of aq. solutions from the equilibrium consts., the law of the conservation of matter, and the principle of electrical neutrality is described. The use of the activity function is discussed and formulæ are given for calculating the activity coeffs. of ions from the Debye–Hückel equation. The effect of temp. on the equilibria is discussed. Formulæ relating the equilibrium consts. to other thermodynamic quantities, *e.g.*, free energy, heats and entropies of reaction, and the e.m.f. of cells, are given. The use of the various formulæ is illustrated by examples selected from the field of corrosion or H_2O treatment. R. B. C.

Exchange and transfer equilibria of acids, bases, and salts in deuterium–protium oxide mixtures. Ion product constant of deuterium oxide. R. W. Kingerley and V. K. LaMer (*J. Amer. Chem. Soc.*, 1941, **63**, 3256—3262).—The equilibrium process $0·5H_2O + KOD(D_2O) + KBr(H_2O) = 0·5D_2O + KOH(H_2O) + KBr(D_2O)$ has been determined from analytical measurements of the process $0·5HgO$ (solid) + $0·5Hg$ (liq.) + $0·5H_2O$ + $KBr(H_2O)$ = $0·5Hg_2Br_2$ (solid) + $KOH(H_2O)$ in H_2O–D_2O mixtures. Ascertained vals. agree well with those calc. by indirect methods. For H_2O measurements were made at 20°, 25°, 30°, and 35°, whilst with D_2O the temp. were 20°, 25°, and 30°. From the temp. coeff. thermodynamic functions have been computed. The difference between exchange and transfer free energy is emphasised. The solubilities of TlCl and $Ca(OH)_2$ in H_2O and in D_2O have been determined at 25°. The exchange coeff. of $Ca(OH)_2$ in H_2O–D_2O has been determined and transfer equilibrium consts. for TlCl and $Ca(OH)_2$ have been calc. The ion product const. of D_2O has been deduced as $1·54 \times 10^{-15}$ in good agreement with the recorded val. (A., 1935, 1076). Equilibria in H_2O–D_2O mixtures is influenced to a greater extent by the free energy of transfer than by free energy of exchange. W. R. A.

Oxidation-decomposition of methane. T. Ogura (*Bull. Chem. Soc. Japan*, 1941, **16**, 262—273).—Introduction to a summary of the author's work. Vals. of equilibrium consts. for a no. of reactions in which CH_4 is oxidised by O_2, H_2O, or CO_2 to CO or CO_2 and H_2 are calc. and tabulated. F. J. G.

Dissociation of calcium and magnesium carbonates and bicarbonates. I. Greenwald (*J. Biol. Chem.*, 1941, **141**, 789—796).—The H' dissociation of H_2CO_3 in $CaCl_2$ or $MgCl_2$ is > in KCl of similar ionic strength; the solubility product $[Ca^{\cdot\cdot}][CO_3^{\prime\prime}]$ in $KHCO_3$ is > in KCl (all salts in aq. solution). These differences are probably due to the formation of complexes of the types $MHCO_3^{\cdot}$ and MCO_3. The physiological significance of this complex formation in plasma and serum is discussed. D. F. R.

Electron-sharing ability of organic radicals. XIV. Effect of the radicals on the ionising power of organic solvents. F. J. Moore and I. B. Johns (*J. Amer. Chem. Soc.*, 1941, **63**, 3336—3338; cf. A., 1942, I, 99).—Conductances and ionisation consts. of picric acid in $COMe_2$, COMeEt, COPhMe, EtCN, and PhCN are determined. The ionisation const. depends on the electron-sharing ability of the radicals of the solvent mol. (the effect being of the same order for ketones and nitriles) and not on the dielectric const. of the solvent. R. S. C.

Ionisation constant of propionic acid in dioxan–water mixtures. H. S. Harned and T. R. Dedell (*J. Amer. Chem. Soc.*, 1941, **63**, 3308—3312).—From the e.m.f. in the temp. range 0—50° of the cell $H_2|EtCO_2H$ (m_1), $EtCO_2Na$ (m_2), NaCl (m_3), dioxan (X), H_2O (Y)|AgCl–Ag the ionisation const. (K) of $EtCO_2H$ has been determined. Vals. of K for HCO_2H, AcOH, and $EtCO_2H$ in dioxan–H_2O are compared and expressed in terms of an equation, from the consts. of which vals. for the changes accompanying ionisation in free energy, heat content, heat capacity, and entropy have been calc. at 25°. The results are discussed in relation to existing theories. W. R. A.

Position of two alicyclic hydrocarbons in the acidity series. R. D. Kleene and G. W. Wheland (*J. Amer. Chem. Soc.*, 1941, **63**, 3321—3322).—Acid strength decreases in the order: CH_2Ph_2 > phenyl*cyclo*pentane > $PhPr^{\beta}$ (I) > phenyl*cyclo*hexane. $CHPh_3$ and $CH(C_6H_3Me_2\text{-}3:5)_3$ could not be compared with each other, but both are stronger than (I). W. R. A.

Activity coefficients of the undissociated part of weak acids. II. Oxalic acid. W. D. Larson and W. J. Tomsicek (*J. Amer. Chem. Soc.*, 1941, **63**, 3329—3331).—The activity coeff. of undissociated $H_2C_2O_4$ does not change in the ionic strength range 0·02—0·33. The e.m.f. of the $Hg|Hg_2C_2O_4(s)$, C_2O_4'' electrode has been found to be $-0·4173\pm0·001$ v. from measurements of the cell $Hg|Hg_2C_2O_4(s)$, $H_2C_2O_4(c)|H_2$. Recalculation of the e.m.f. data (A., 1938, I, 31) for the cell $Cd(Hg)|CdC_2O_4,3H_2O(s)$, $H_2C_2O_4(m)$, quinhydrone|(Pt) confirms the constancy of the activity coeff. of $H_2C_2O_4$. W. R. A.

Hydration of aluminium sulphate. N. O. Smith (*J. Amer. Chem. Soc.*, 1942, **64**, 41—44).—From a study of parts of the ternary systems MSO_4–$Al_2(SO_4)_3$–H_2O (M = Cu, Fe, Ni) at 25° evidence is adduced that the heptadecahydrate is the stable form of $Al_2(SO_4)_3$ in equilibrium with its saturated aq. solution. $Al_2(SO_4)_3,17H_2O$ has been prepared by crystallisation at low temp. W. R. A.

System silver nitrate–dioxan–water at 25°. J. A. Skarulis and J. E. Ricci (*J. Amer. Chem. Soc.*, 1941, **63**, 3429—3431).—The system $AgNO_3$–H_2O–dioxan has been investigated at 25° and evidence for a solid dioxanate of $AgNO_3$, $(AgNO_3)_8,C_4H_8O_2$ ($AgNO_3$ ~94%), is presented. W. R. A.

System aniline–chlorobenzene. Equilibria between liquid and vapour at pressures below atmospheric. K. E. Coulter, R. A. Lindsay, and E. M. Baker (*Ind. Eng. Chem.*, 1941, **33**, 1251—1253).—A modified equilibrium still for the determination of liquid and vapour equilibria at < atm. pressure is described. The v.p. of pure PhCl and NH_2Ph and the variations of the vapour composition and b.p. with concn. in the system PhCl–NH_2Ph at various total pressures are recorded in curves. Contrary to the usual belief that reduced pressure facilitates separation by distillation, the relative volatility in this system decreases slightly with reduction in pressure. J. W. S.

Equilibrium diagram of the system carbon tetrachloride–*tert.*-butyl chloride as revealed by dielectric constant measurements. W. P. Conner and C. P. Smyth (*J. Amer. Chem. Soc.*, 1941, **63**, 3424—3428).—The dielectric consts. (ϵ) of a continuous series of solid solutions of CCl_4 and Bu^tCl have been measured at 170—270° K. at frequencies of 0·5, 5, and 50 kilocycles per sec. The temp. of rotational transition of each compound is lowered by addition of the other compound. An equilibrium diagram for the system has been constructed. So long as the mols. in the solid possess freedom of rotation their lattices are isotropic, but when mol. rotation is stopped the lattices become anisotropic. W. R. A.

Iron–iron sulphide–iron silicide system. R. Vogel, C. Uschinski, and U. Theune (*Arch. Eisenhüttenw.*, 1941, **14**, 455—462; *Bull. Iron Steel Inst.*, 1941, No. 72, 72 A).—The system was studied by thermal and microscopical examinations of melts prepared by first adding Si to molten Fe, allowing time for the temp. rise due to Fe silicide formation to subside, and then adding S. In the liquid state Fe sulphide and Fe silicide are only slightly sol. in each other. This is the cause of the extensive miscibility gap in the region investigated. Its course and that of the tie-lines and the occurrence of a lower crit. point near to the Fe–Fe sulphide boundary have been established. Special details are a three-phase equilibrium, a max. temp. on the miscibility surface, and a three-phase eutectic with a temp. max., one solid phase of which is the superstructure solid solution Fe_2Si. Si, like C and P, when added to molten Fe containing S causes a S-rich layer to separate out; it thus favours the effect of Mn in desulphurising pig Fe. R. B. C.

Heats of dissociation of some hexa-arylethanes. R. Preckel and P. W. Selwood (*J. Amer. Chem. Soc.*, 1941, **63**, 3397—3403).—Vals. of the magnetic susceptibility χ have been obtained by the Gouy method for PhMe solutions of C_2Ph_6, $C_2Ph_4(C_6H_4Me\text{-}o)_2$, $C_2Ph_4.(C_{10}H_7\text{-}1)_2$, and $C_2Ph_2(C_6H_4Me\text{-}o)_4$ for different temp. and concns.; the data support the "resonance," rather than the "steric," theory of free radical stability. Ebullioscopic measurements and the intensity of the colour of solutions are considered to be inaccurate in studying free radical behaviour and concn. The extent of the dissociation is obtained from the magnetic data, and from the equilibrium consts. and their variation with temp. vals. of ΔF, ΔH, and ΔS are derived and tabulated. W. R. A.

Thermodynamic theory of solutions of two liquids at all concentrations. J. L. Finck (*J. Franklin Inst.*, 1942, **233**, 51—70).—The treatment previously described (A., 1938, I, 311) is extended to the mixing of two chemically pure liquids, to form a solution of any concn. The presence of a catalyst is postulated. The process of mixing is analogous to evaporation, and osmotic pressure is analogous to v.p. Relations between osmotic pressure and the e.m.f. of a concn. cell are developed, and a mathematical relation between latent heat of dissolution, the sp. vols. of the two liquids and the solution, concn., and e.m.f. and charge of the concn. system is derived. F. L. U.

Entropies of nitric acid and its mono- and tri-hydrates. Heat capacities from 15° to 300° K. Heats of dilution at 298·1° K. Internal rotation and free energy of nitric acid gas. Partial pressures over its aqueous solutions. W. R. Forsythe and W. F. Giauque (*J. Amer. Chem. Soc.*, 1942, **64**, 48—61).—Vals. of C_p have been determined for HNO_3 (13·51—302·89° K.), HNO_3,H_2O (14·91—298·63° K.), and $HNO_3,3H_2O$ (14·84—295·58° K.). The m.p. are, respectively, 231·51°, 235·48°, and 254·63° K.; heats of fusion 2503 ± 2, 4184 ± 1, and 6954 ± 4 g.-cal. per mol.; heats of dilution at 298·1° -7971 ± 10, -4732 ± 8, and -2123 ± 5 g.-cal. per mol.; entropies 37·19, 51·84, and 82·93 g.-cal. per degree per mol. Available partial pressure data over aq. HNO_3 have been investigated by the Duhem equation and errors in existing experimental data have been revealed. No appreciable association exists in the vapour over HNO_3 solutions. The partial pressure data have been extended over the range 50—100% HNO_3 at 20°. Using entropy vals. derived, entropy of H_2O and measured heats of hydration, vals. for free energies of hydration of both hydrates have been calc. in excellent agreement with free energies for isothermal hydration. It is, therefore, concluded that if H-bonding occurs in the lattice structure, as is probable, no randomness exists at low temp. The entropy of gaseous HNO_3 is 63·62 g.-cal. per degree per mol. at 298·1° K. and 1 atm.; this val., combined with mol. data, indicates that there is a double potential barrier of 7000 g.-cal. per mol. restricting internal rotation. The following have also been computed: free energy, heat content, and entropy functions of HNO_3 gas; heat of reaction at 0° K. and equilibrium const. at 500° K. for $2HNO_3(g) + NO = H_2O(g) + 3NO_2$, $2HNO_3(g) = H_2O(g) + 2NO_2 + 0·5O_2$, and $2HNO_3(g) = H_2O(g) + 2NO + 1·5O_2$; and free energies and heats of formation from the elements for HNO_3(liq.), $HNO_3(g)$, and HNO_3(aq. $a = 1$). W. R. A.

Entropy of acetic acid. J. O. Halford (*J. Chem. Physics*, 1941, **9**, 859—863).—From third-law measurements (v.p. and v.d.) the entropy of monomeric AcOH at 25° is $69·4\pm1·0$ g.-cal. per degree per mol., whereas the val. calc. from the vapour-phase EtOAc equilibrium is 68·7 and that calc. for a model based on $COMe_2$, and approx. representing free rotation, is 72·7. It is assumed that in the entire rotational cycle there is only a single potential min. of sufficient depth to trap the OH group. For such a model, with vibration restricted to the ground state, the entropy would be 68·3 plus a small increment owing to the use of the $COMe_2$ vibrational entropy. W. R. A.

VII.—ELECTROCHEMISTRY.

Calculation of corrections to conductivity measurements [of water] for dissolved gases. D. S. McKinney (*Amer. Soc. Test. Mat., Preprint*, June, 1941, 11 pp.).—Methods based partly on the author's earlier work (*ibid.*, 1939, **39**, 1191) are outlined. Procedures for correcting the conductivity of condensed steam when analysis only of the steam is available, and for calculating the correction to be applied to a steam sample from partial analysis of steam and boiler-

H_2O are given. Tables of data needed for the calculations showing (*a*) the ionic equiv. conductance, λ_0, of the ions commonly found in industrial H_2O; (*b*) the variation of the equiv. conductance Λ, with concn. for Na_2SO_4, NaCl, and NaOH; and (*c*) the distribution of the ions of the weak electrolytes H_2O, H_2S, CO_2, SO_2, NH_3, and H_3PO_4 as a function of p_H, are presented. R. B. C.

Conductance of potassium iodate at 25° and mobility of the iodate ion. K. A. Krieger and M. Kilpatrick (*J. Amer. Chem. Soc.*, 1942, **64**, 7—9).—Vals. of Λ for aq. KIO_3 (0·0001—0·1M.) have been measured at 25°; Λ_0 is 114·00±0·05. From existent data for Λ_{0KCl} and $\lambda_{0Cl'}$, $\lambda_{0IO_3'}$ is 40·48±0·05. W. R. A.

High mol. wt. aliphatic amines and their salts. IV. Electrical conductivities of aqueous solutions of hydrochlorides and acetates of dodecyl- and octadecyl-amines. A. W. Ralston, C. W. Hoerr, and E. J. Hoffman (*J. Amer. Chem. Soc.*, 1942, **64**, 97—101; cf. A., 1942, I, 58).—Vals. of conductivities and ρ of aq. acctates and hydrochlorides of $C_{12}H_{25}\cdot NH_2$ (I) and $C_{18}H_{37}\cdot NH_2$ (II) have been determined from 0° to 60°. Conductivity curves show the three ranges characteristic of colloidal electrolytes. Over the first range the salts behave as strong electrolytes, agreeing with the Onsager equation. Micelle formation begins at approx. 0·013M. for (I) and 0·0003M. for (II). Vals. for Λ_0, l_c, and n_c at infinite dilution have been calc. W. R. A.

Oxidation–reduction equilibrium, over the whole p_H range, of oxonine and related dyes.—See A., 1942, II, 118.

VIII.—REACTIONS.

Isotope separation and combustion mechanism in ascending hydrogen–deuterium flames. K. Clusius, W. Kölsch, and L. Waldmann (*Z. physikal. Chem.*, 1941, **A, 189**, 131—162).—At 600 mm. total pressure the lower ignition limit for H_2 in O_2 lies at 3·80% of H_2 and for D_2 in O_2 at 5·30% of D_2; for a 1 : 1 H_2–D_2 mixture the limit lies at 4·55% of mixture. The ratio of the limiting concns. for the two gases is approx. the same as the ratio of their diffusion coeffs. against O_2. The difference between the two limits can be made use of in order to separate H_2 from D_2 in admixtures, H_2 being preferentially burnt in presence of O_2, so increasing $[D_2]$ in the residual gas. The mechanism of the combustion is discussed theoretically. C. R. H.

Oxidation of nitric oxide. Rate of reaction between carbon monoxide and nitrogen dioxide. F. B. Brown and R. H. Crist (*J. Chem. Physics*, 1941, **9**, 840—846; cf. A., 1939, I, 568).—The initial rate of reaction between CO and NO_2 has been measured from 225° to 290° under conditions which precluded decomp. of NO_2. Combined with existing data the reaction over a range of 300° has been studied. The energy of activation is 27·8 kg.-cal. The rate of the reaction is so low that no correction for it is necessary in the experiments on CO, O_2, NO, and NO_2 mixtures between 25° and 256°. Oxidation of NO at 25° and at pressures of NO 0·01 to 0·1 mm. is of the third order over a 3- and 6-fold change in reactants. The production of CO_2 and NO_2 at ~150° in mixtures of NO, CO, and O_2 has been measured, precautions being taken to prevent formation of CO_2 by reaction between CO and NO_2. The intermediate formation of NO_3 in the oxidation of NO is postulated. The rate of reaction between NO_3 and NO is > that between NO_2 and CO. A new apparatus containing greaseless valves and capable of handling 10^{-3} mm. of products is described. A method of analysis of products with a precision of 3×10^{-5} mm. has been developed. W. R. A.

Mechanism and kinetics of reactions involving free radicals. W. A. Waters (*Trans. Faraday Soc.*, 1941, **37**, 770—780).—A general survey. F. L. U.

Statistics of intramolecular aldol condensations in unsaturated ketone polymerides. P. J. Flory (*J. Amer. Chem. Soc.*, 1942, **64**, 177—179).—Intramol. condensation of neighbouring substituents of a long-chain polymeride, where each substituent is bifunctional, is treated statistically. W. R. A.

Exchange reaction of diacetyl with deuterium oxide. W. D. Walters (*J. Amer. Chem. Soc.*, 1941, **63**, 2850—2851).—The exchange reaction of Ac_2 with D_2O (98%) alone and in admixture with HCl has been studied at 25° and 56° and vals. of the rate of exchange (k') are tabulated. $k' \propto$ [HCl] over a five-fold change in [HCl] up to 1N. The activation energy for the reaction is ~23·9 kg.-cal. k' is compared with existent data for $COMe_2$ and the mechanism of the reaction is briefly discussed. W. R. A.

Kinetic considerations of the thermal decomposition of benzenediazonium chloride in various solvents. C. E. Waring and J. R. Abrams (*J. Amer. Chem. Soc.*, 1941, **63**, 2757—2762).—The rate of decomp. (k) of PhN_2Cl has been studied in *iso*amyl (I) and active amyl (II) alcohols and in *tert.*-amyl alcohol and $CHMePr^{\alpha}\cdot OH$ in admixture with EtOH to effect dissolution, over the temp. range 20° to 40°. k is approx. const. in all solvents and the activation energy (E) is 26,620 for (I) and 27,260 g.-cal. per mol. for (II). Comparison with existent data for six alcohols, four acids, and H_2O shows a divergence in E, indicating the variation in some function such that k remains const. Log PZ varies linearly with E and the relative importance of bond strengths and repulsive energies involved in the decomp. of PhN_2Cl is discussed. The proposed mechanism for the decomp. involves the initial solvation of PhN_2Cl and then formation of the free radicals Ph and Cl which then react with solvent mols. The mechanism is in agreement with observed results, *i.e.*, constancy of k in all solvents and in the presence of acids or common ions. The variation of E with the no. of C atoms in the solvents is represented graphically and yields a min., the theoretical implications of which are discussed. W. R. A.

Dielectric and solvent effects on alkaline fading of bromophenol-blue. E. S. Amis and S. E. Cook (*J. Amer. Chem. Soc.*, 1941, **63**, 2621—2625).—The reaction between the negative bromophenol-blue ion and OH′ (from NaOH) has been investigated from 10° to 60° in iso-composition and iso-dielectric glycerol (I)–H_2O media. The trend of the energies of activation is opposite to the electrostatic theory and is attributed to an equilibrated reaction between NaOH and (I). At high concns. of (I) the observed rates (k), corr. for dielectric effects, $\propto$ the mol. fraction of (I), whilst at low concns. of (I) k rapidly approached the H_2O point due to hydrolysis of the compound formed between NaOH and (I). An equation is derived for the difference of the Arrhenius frequency factor B in iso-composition and iso-dielectric media. Observed results agree with other data. W. R. A.

Kinetics and mechanism of electrophilic benzene substitution reactions. A. E. Bradfield and B. Jones (*Trans. Faraday Soc.*, 1941, **37**, 726—743).—The processes of nitration, sulphonation, chlorination, and bromination of C_6H_6 and its derivatives are discussed. Probably all involve simple bimol. mechanisms unaccompanied by unimol. Changes in reaction rate caused by varying the substituents are due entirely to changes in the activation energy E, whilst the val. of E is determined additively by characteristic quota E_1, E_2, etc., contributed by the individual substituents. F. L. U.

Mechanism and kinetics of anionotropic change. M. P. Balfe and J. Kenyon (*Trans. Faraday Soc.*, 1941, **37**, 721—725).—Examples are given of reactions that can be recognised as taking place by rearrangement or by replacement according to whether the rotatory power due to an optically active group originally present is or is not retained. The spontaneous rearrangement of (+)-CHEt:CH·CHMe·OH into (+)-CHMe:CH·CHEt·OH, which is accompanied by some racemisation, appears to be reversible and intramol. F. L. U.

Mechanism and kinetics of elimination reactions. E. D. Hughes and C. K. Ingold (*Trans. Faraday Soc.*, 1941, **37**, 657—685).—1 : 2-Elimination from saturated compounds is surveyed and discussed from the points of view of mechanism and environmental and constitutional influences. F. L. U.

Mechanism and kinetics of aromatic side-chain substitution. Interpretation of reaction data by the method of relative energy levels. J. W. Baker (*Trans. Faraday Soc.*, 1941, **37**, 632—644).—A survey dealing mainly with bimol. nucleophilic substitutions. F. L. U.

Mechanism and kinetics of substitution at a saturated carbon atom. E. D. Hughes (*Trans. Faraday Soc.*, 1941, **37**, 603—631).—A survey of recent progress. F. L. U.

Mechanism and kinetics of ring closure. G. M. Bennett (*Trans. Faraday Soc.*, 1941, **37**, 794—803).—A survey of recent work dealing principally with the formation of large rings. F. L. U.

Activation energy of ionic substitution. E. C. Baughan and M. Polanyi (*Trans. Faraday Soc.*, 1941, **37**, 648—654).—A simplified theory applying to negative substitutions of the type Cl′ + RCl = ClR + Cl′ is based on one previously developed (cf. A., 1935, 452) for the closely related unsymmetrical reaction. The method employed is to determine the curve along which the energy surfaces relating to the initial and final chemical states cross, without plotting the surfaces themselves. F. L. U.

Mechanism and kinetics of additions to olefinic compounds.—See A., 1942, II, 125.

Mechanism of the Cannizzaro reaction and some allied processes.—See A., 1942, II, 131.

Mechanism and kinetics of carboxylic ester hydrolysis and carboxyl esterification. J. N. E. Day and C. K. Ingold (*Trans. Faraday Soc.*, 1941, **37**, 686—705).—A survey of recent work. Three out of the seven theoretically deduced mechanisms have already been confirmed by kinetic studies. F. L. U.

Saponification of acetylsalicylic acid at 35°. J. M. Sturtevant (*J. Amer. Chem. Soc.*, 1942, **64**, 77—80).—The velocity of saponification of acetylsalicylic acid (I) at 35° has been investigated by the calorimetric method and results agree with those required by Brönsted's theory. The heat of ionisation of (I) at 35° is −3500 joules per mol. W. R. A.

Cleavage of the alkyl–oxygen bond in the hydrolysis of esters.—See A., 1942, II, 141.

Graphical calculation of non-isothermal reactions. J. W. Greene, J. B. Sutherland, and G. Sklar (*Ind. Eng. Chem.*, 1942, **34**, 65—67).—A graphical method for calculating the variation of reaction coeff. with time for reactions accompanied by temp. change and thence calculating the degree of completion of the reaction after the elapse of various periods of time is developed. The calc. results are in accord with experiment for the hydrolysis of corn starch in N-acid. J. W. S.

Kinetic studies in ester hydrolysis. I. Hydrolysis of halogeno-aliphatic esters. II. Influence of solvent on reaction. S. V. Anantakrishnan and S. Krishnamurti (*Proc. Indian Acad. Soc.*, 1941, **A**, **14**, 270—278, 279—288).—I. The kinetics of the acid hydrolysis of Et esters of AcOH, $CH_2X{\cdot}CO_2H$ (X = Cl, Br, I), $EtCO_2H$, α- and β-chloro-, -bromo-, and -iodo-propionic acids, and $Pr^{\alpha}CO_2H$ by 0·1N-HCl in 60% dioxan–H_2O have been investigated at 35°, 42°, 56°, and 60°. The effect of halogen substitution on *E* and *PZ* in the Arrhenius equation is discussed from the viewpoint of the electronic theory of org. reactions.

II. Previous work is extended to EtOAc, $EtCO_2Et$, and $CH_2Cl{\cdot}CO_2Et$ in aq. glycerol of various concn. and compared with aq. dioxan and aq. EtOH. η and ϵ of the solvent influence the reaction and a correlation of vals. of *E* and *PZ* is shown. W. R. A.

Kinetics of the degradation of non-degraded potato and maize starches by β-amylase.—See A., 1942, II, 82.

Rate of reaction of phosphorus pentoxide with rock phosphate.—See B., 1942, I, 137.

Production of atomic iodine in the reaction of peroxides with iodide ion. H. Taube (*J. Amer. Chem. Soc.*, 1942, **64**, 161—165).—The oxidation of C_2O_4'' ions is induced by S_2O_8'' and Ac_2O_2 but not by AcO_2H and H_2O_2. The induced oxidation involves the production of at. I. W. R. A.

Reaction between ethyl iodide and copper salts. V. D. Taskar, M. S. Telang, and V. V. Nadkarny (*Current Sci.*, 1941, **10**, 404).—The apparent accelerating effect of a Cu salt on the persulphate–alkyl iodide (I) reaction (cf. A., 1940, I, 121) is due to a reaction between the Cu salt and (I) in which free I is produced. This reaction can be followed iodometrically if the I is extracted from the reaction products with C_6H_6 before titration; it is of the first order with respect to (I), and probably occurs by dissociation of the (I), followed by a faster reaction of $Cu^{\cdot\cdot}$ with I or I'. A. J. E. W.

Dielectric properties of hydrocarbons and hydrocarbon oils. Influence of oxidation. J. C. Balsbaugh, A. G. Assaf, and J. L. Oncley (*Ind. Eng. Chem.*, 1942, **34**, 92—100).—Oxidation of cetane in presence of Cu proceeds rapidly after an initial induction period, a Cu salt, probably Cu glutarate, being formed. The oxidation is less rapid in the absence of Cu. *cis*-Decalin is oxidised rapidly but Cu and paper inhibit this oxidation after the O_2 absorption has exceeded ~13 l. per kg. The oxidation of decane shows no induction period and in its early stages is unaffected by the presence of Cu, although Cu acts as an inhibitor in the later stages, when a Cu salt is formed. Cetene is not oxidised more rapidly than the saturated hydrocarbons. Various hydrocarbon oils show oxidation phenomena similar to those of the pure compounds. Electrical conductivity and ϵ measurements on the oils alone and in the presence of paper have been correlated with the degree of oxidation. The use of a limited oxidation test for evaluating the power factor stability of an oil in presence of Cu is suggested. J. W. S.

Prototropic changes of carbonyl compounds. H. B. Watson (*Trans. Faraday Soc.*, 1941, **37**, 713—716).—Acid- and base-catalysed prototropic changes are briefly discussed. The influence of electron-attracting substituents in directing the change via the basic mechanism is illustrated by the reactions of the halogenated acetones. F. L. U.

Mechanism of addition and condensation reactions of carbonyl compounds. H. B. Watson (*Trans. Faraday Soc.*, 1941, **37**, 707—713).—Reactions of the aldol type (Knoevenagel, Claisen, Perkin) and ester condensation (Claisen) type are discussed. The mechanisms accepted are substantially those put forward by Lapworth. The functions of acid and basic catalysts are considered. Reactions of CO compounds with NH_2OH and N_2H_4 and its derivatives probably follow an analogous course. F. L. U.

***cis–trans* isomerisations. I. Mechanism of a catalysed isomerisation of maleic acid to fumaric acid.** K. Nozaki and R. Ogg, jun. **II. Mechanism of the amine-catalysed isomerisation of diethyl maleate.** K. Nozaki (*J. Amer. Chem. Soc.*, 1941, **63**, 2583—2586, 2681—2683).—I. The isomerisation of maleic to fumaric acid in H_2O at 99·9° catalysed by HCl, HBr, H_2SO_4, KCNS, NH_4CNS, and NaBr, and at 79·8° catalysed by HCl and KCNS, has been investigated. The activation energy with HCl is 24,900 g.-cal. and with KCNS 18,800 g.-cal. The proposed mechanism of isomerisation involves the addition of a proton and the anion of the catalysing agent, a shift of double bond, and a Walden inversion, and is in agreement with observed results. The application of the mechanism to other *cis–trans* isomerisations is discussed.

II. Extension of previous work to the isomerisation of Et_2 maleate to Et_2 fumarate in Et_2O at 24·9° and 0°, catalysed by 12 amines. *tert.*-Amines, in agreement with theory, did not catalyse the isomerisation. The application of the mechanism to all αβ-unsaturated esters and acids is discussed. W. R. A.

Mechanism of the peroxide-catalysed polymerisation of *d*-sec.-butyl α-chloroacrylate. C. C. Price and R. W. Kell (*J. Amer. Chem. Soc.*, 1941, **63**, 2798—2801).—Kinetics of the polymerisation of $d\text{-}CH_2{:}CCl{\cdot}CO_2Bu\text{-}sec.$ catalysed by Bz_2O_2 have been investigated in dil. dioxan solution at 26°, 44°, 52°, 60°, and 68° using the polarimetric technique (cf. A., 1941, II, 84). The rate of reaction $\propto$ the concn. of monomeride and $[Bz_2O_2]^{\frac{1}{2}}$. Results agree with the mechanism of macro-polymerisation involving a free radical chain reaction. For Bz_2O_2 it is suggested that the chain is initiated by free radicals formed by thermal decomp. of Bz_2O_2. W. R. A.

Alcoholysis of polyvinyl acetate. L. M. Minsk, W. J. Priest, and W. O. Kenyon (*J. Amer. Chem. Soc.*, 1941, **63**, 2715—2721).—The alcoholysis of polyvinyl acetate (I) of varying mol. wt. and concn. in abs. MeOH, catalysed by HCl and NaOH in varying amount, has been studied at 10° and 30° up to 50% alcoholysis. The rate of reaction depends on (i) the concn. of the basic catalyst, (ii) the 1·22 power of the concn. of the acidic catalyst, and (iii) approx. the first power of the concn. of (I), and is independent of the mol. wt. of (I). The energy of activation is 13,000 g.-cal. for the basic and 13,200 g.-cal for the acidic catalysts. The reaction possesses apparent autocatalytic characteristics which may be due either to an autocatalytic or to a stepwise nature. The effect of moisture on the reaction is briefly discussed. The reaction is explained qualitatively as due to the degree of deacetylation of (I) rather than to external causes. W. R. A.

Mechanism of mutarotation of *d*-hydroxymethylenecamphor.—See A., 1942, II, 106.

Mechanism of the Friedel–Crafts reaction.—See A., 1942, II, 136.

Comparison of metallic chlorides as catalysts for the Friedel–Crafts ketone synthesis.—See A., 1942, II, 143.

Mechanism of the steam–carbon reaction. G. S. Scott (*Ind. Eng. Chem.*, 1941, **33**, 1279—1285).—Data relating to the C–H_2O reaction are reviewed. These indicate that since in the reaction between lignite char and steam at <1000° the dry gas composition of the products approaches CO_2 33⅓% and H_2 66⅔% at very brief contact time (B., 1934, 786), the initial reaction is probably $C + 2H_2O = CO_2 + 2H_2$. The total reaction at 700—1200° is approx. of second order with activation energy 26,000 g.-cal. per mol. Results with coke are more inconclusive but in general accord with those obtained with lignite char. The importance of the presence of catalytic materials in the ash of the coke is emphasised. J. W. S.

Preparation of palladium and platinum synthetic high-polymeride catalysts and relationship between particle size and rate of hydrogenation. L. D. Rampino and F. F. Nord (*J. Amer. Chem. Soc.*, 1941, **63**, 2745—2749).—Catalysts of Pd-polyvinyl alcohol (I), $-CH_2{:}CMe{\cdot}CO_2Me$ (II), -Me polyacrylate (III) and of Pt-polyvinyl alcohol (IV) have been prepared and compared with the catalysts Pd-gum arabic, -gum tragacanth, -C, and $-BaSO_4$. (I) and (IV) were studied in H_2O and aq. EtOH whilst (II) and (III) were studied in AcOH, C_6H_6, and $COMe_2$ alone and in admixture. (I), (II), (III), and (IV) were equally efficient in acid, neutral, and alkaline media, and with the exception of Pd–$BaSO_4$ were superior to the other catalysts studied. The efficiency of (I) increased with increasing degree of polymerisation of polyvinyl alcohol, (V). Comparison of Au nos. shows that whilst the Au no. of (V) is < of gum arabic. (V) is more efficient than gum arabic as a supporter. (I) was efficient for the reaction $CO + H_2O \rightarrow CO_2 + H_2$ and in the hydrogenation of castor and fish oil yields solid products, the fish oil losing the fishy odour. W. R. A.

Vapour-phase esterification of benzoic acid with ethyl alcohol. Effect of oxides on the catalytic activity of silicon carbide and alundum. A. A. Vernon and B. M. Brown (*Ind. Eng. Chem.*, 1933, **33**, 1289—1291; cf. A., 1940, I, 262).—SiC and alundum are less active than SiO_2 in catalysing esterification of BzOH with EtOH in the vapour phase, but cause less carbonisation. When metallic oxides suspended on these materials as carriers are used as catalysts their activity varies with the carrier used. TiO_2 on Al at 370°, Mn_2O_4 on SiC at 410°, and MgO on SiC at 450° show the greatest activity. The first two give decreasing yields with increasing rate of passage of the vapours through the catalyst, owing to side reactions. Life tests on TiO_2 catalysts, however, indicate that side reactions decrease and the efficiency of the esterification process increases with use. MgO on SiC is the best catalyst at low rates of flow. J. W. S.

Influence of support structure and method of preparation of platinum catalysts. T. Schoon and E. Beger (*Z. physikal. Chem.*, 1941, **A**, **189**, 171—182).—The activity of Pt catalyst supported on asbestos, Al_2O_3, C, and SiO_2 gel for the decomp. of H_2O_2, hydrogenation of C_2H_4, and dehydrogenation of C_2H_6 has been investigated,

and ultramicrographs of the catalyst surfaces are reproduced. In general, fine crystal structure favours hydrogenation and conglomerates favour dehydrogenation. C. R. H.

Catalytic poisoning in liquid-phase hydrogenation. Effect of sulphur compounds of various degrees of oxidation.—See B., 1942, 11, 45.

Electrodeposition of cadmium on iron.—See B., 1942, I, 151.

Anodic treatment of aluminium in the chromic acid bath.—See B., 1942, I, 160.

Effect of wetting agents on electrodeposition of nickel.—See B., 1942, I, 156.

[Applications of] porous carbon electrodes. III. Reduction of *p*-nitroaniline.—See B., 1942, II, 45.

Effects of a high-voltage discharge on the thermal decomposition of ethane. I. H. Parrill and W. G. Eversole (*Ind. Eng. Chem.*, 1941, **33**, 1316—1317).—The decomp. of C_2H_6 in a 75,000-v. discharge from an induction coil and in a 15,000-v. transformer discharge has been studied at 100—450°. The amount of H_2 and C_2H_4 formed in the transformer discharge reaches a max. at ~300°, and above this temp. the yield of CH_4 increases rapidly with rise of temp. With the coil discharge there is little increase in the % of CH_4 produced with rise of temp. J. W. S.

Mercury-photosensitised reactions of ethylene. D. J. LeRoy and E. W. R. Steacie (*J. Chem. Physics*, 1941, **9**, 829—839).—Reactions of C_2H_4 photosensitised by $^3P_1$ Hg radiation have been investigated. The products are H_2, C_2H_2, C_4H_{10}, butene, and hexenes. The variation of the rate with the pressure of C_2H_4 suggests that the following deactivation process is involved: $C_2H_4 + Hg\ (^3P_1) \rightarrow C_2H_4^* + Hg\ (^1S_0)$; $C_2H_4^* + C_2H_4 \rightarrow 2C_2H_4$; $C_2H_4^* \rightarrow C_2H_2 + H_2$. Polymerisation results from a free radical mechanism and the formation of C_4H_{10} is considered to occur according to $H_2 + Hg\ (^3P_1) \rightarrow 2H + Hg\ (^1S_0)$; $H + C_2H_4 \rightarrow C_2H_5$; $2C_2H_5 \rightarrow C_4H_{10}$. The suggested mechanisms are consistent with the val. found for the quantum yield. W. R. A.

Photochemistry of *iso*butene. I. W. F. Kieffer and J. P. Howe (*J. Amer. Chem. Soc.*, 1942, **64**, 1—7).—When *iso*butene (I) is irradiated with 1900 A., decomp. and polymerisation occur. Near the max. rate the data are summarised by the following quantum yields: H, 0·03; CH_4, 0·10; hydrocarbon with 2·25 C per mol., 0·16; polymeride with 9·05 C per mol., 0·45. All observed processes can be interpreted by free radical mechanisms. At low pressures the excited (I) mol. is split into primary free radicals which recombine on the walls and in the gas phase and react with (I) mols. At higher pressures excited mols. are quenched and the radicals which are formed react with (I) to form other radicals which combine. The reaction is influenced by the nature of the wall. No $CH{:}CMe$ was found among the products. W. R. A.

Photochemical chlorination and chlorine-activated oxidation of pentachloroethane. H. J. Schumacher and W. Thürauf (*Z. physikal. Chem.*, 1941, **A**, **189**, 183—199).—The rate of photochemical chlorination of $C_2HCl_5 \propto [Cl_2]$ and $I^{0.5}$ (I = light quanta absorbed). The reaction is inhibited by O_2 as a result of oxidation of C_2HCl_5. This oxidation increases with increase in $[O_2]$, both $CCl_3{\cdot}COCl$ and $COCl_2$ being formed in the ratio ~5 : 1. Oxidation decreases with rise of temp. The kinetics of both reactions are discussed. Cl atoms, formed by light absorption, react with C_2HCl_5 to form HCl and C_2Cl_5, thel atter, in absence of O_2, being chlorinated to C_2Cl_6. In presence of O_2, C_2Cl_5 forms a peroxide, $C_2Cl_5O_2$, which decomposes either to $2COCl_2 + Cl$ or to $CCl_3{\cdot}COCl + ClO$. ClO then reacts with an additional mol. of C_2HCl_5 to form $CCl_3{\cdot}COCl + HCl + Cl$. C. R. H.

Polymerisation of olefines induced by free radicals. C. J. Danby and C. N. Hinshelwood (*Proc. Roy. Soc.*, 1941, **A**, **179**, 169—193).—The photolysis of aldehydes at 300° is reduced by C_2H_4, C_2H_6, or *iso*-C_4H_8 and many mols. of the olefine may be polymerised for each quantum of light absorbed by the aldehyde. A similar polymerisation is induced by photolysis of ketones. The reactions were investigated by combining pressure measurements with chemical analysis at each stage, the rates of olefine polymerisation and of aldehyde photolysis being independently determined. It is concluded that large radicals are built up by the successive addition of olefine mols. to the primary radicals from the photolysis of the aldehyde or ketone. When the polymeride radicals contain about three olefine mols. they break down, either (*a*) regenerating a Me radical which begins a new polymerisation chain or (*b*) giving inactive products. There is no marked diminution in reactivity of the alkyl radicals as the series is ascended but the polymerisation rate diminishes rapidly in the series C_2H_4, C_3H_6, *iso*-C_4H_8. G. D. P.

Photochemical decomposition of cyclic ketones. S. W. Benson and G. B. Kistiakowsky (*J. Amer. Chem. Soc.*, 1942, **64**, 80—86).—The absorption spectra and v.p. of *cyclo*-butanone (I), -pentanone (II), and -hexanone (III) have been measured. The photochemical decomp. of each has been investigated in a flow system over the temp. range 150—350° and at pressures of from 30—200 mm. and the products have been analysed. (I) yields $C_2H_4 + CO$ (~40%) and $C_2H_4 + CH_2{:}CO$ (~60%); (II) *cyclo*butane + CO (38%) and $2C_2H_4 + CO$ (62%); (III) C_5H_{10} (75% *cyclo*pentane and 25% Δ^{α}-pentene) + CO (98%), $C_2H_4 + C_2H_6 + CO$ (2%), *cyclo*hexenyl-*cyclo*hexanone + H_2O (variable), and very small amounts of an unknown polymeride. The photolysis of (III) is much more complex than the simple reaction postulated by Norrish (A., 1938, I, 632). The ratio of the quantities of gaseous products is independent of temp. and pressure. The quantity of condensation products formed by (III) depends on both temp. and pressure. The primary process in the absorption of light involves the splitting of one bond and formation of a polymethylene biradical. Photolysis of (II) is suggested as a convenient means of synthesising *cyclo*butane. W. R. A.

Photo-synthesis in flashing light.—See A., 1942, III, 276.

Reversible photochemical processes in rigid media. Phosphorescent state.—See A., 1942, I, 82.

IX.—METHODS OF PREPARATION.

Chemical processes in which solids participate. II. G. F. Hüttig (*Kolloid-Z.*, 1941, **95**, 258—283; cf. A., 1942, I, 160).—Summary and bibliography. F. L. U.

Separation tube. III. Production of 2·5 litres of the pure isotopes ^{22}Ne and ^{20}Ne. G. Dickel and K. Clusius (*Z. physikal. Chem.*, 1940, **B**, **48**, 50—62).—Using a 29-m. separation tube 2·5 l. of ^{22}Ne (99·7% ^{22}Ne) was obtained and on the light side ^{20}Ne (99·8%) was formed. At. wts. of both isotopes have been determined by mass spectral methods and from ρ measurements. 2 l. of Ne in which the rare isotope ^{21}Ne was enriched from 0·27% to 2·5% were obtained. W. R. A.

Oxychlorides of silicon and corresponding ethyl esters. W. C. Schumb and D. F. Holloway (*J. Amer. Chem. Soc.*, 1941, **63**, 2753—2755).—By the action of Cl_2 and O_2 (by vol. 2 : 1) on cryst. Si at dull red heat $(SiOCl_2)_4$ and the homologues $Si_nO_{n-1}Cl_{2n+2}$ (n = 2—7) have been prepared. The homologues are colourless, oily liquids, which hydrolyse in presence of moisture, increase in viscosity as n increases, mix with CCl_4, $CHCl_3$, CS_2, and $SiCl_4$, and yield esters (n = 2, 3, 4, 6) with EtOH. The esters are colourless, oily liquids, miscible with CCl_4, CS_2, and EtOH, practically incombustile in air, and are not hydrolysed even after prolonged contact with H_2O at 100°. The esters can be prepared from oxybromides by NaOEt but not from oxybromides by EtOH. The following (b.p. in parentheses) are described: $Si_3O_3Cl_8$ (76°/15 mm.), $Si_4O_3Cl_{10}$ (109—110°/15 mm.), $Si_5O_4Cl_{12}$ (130—131°/15 mm.), $Si_6O_5Cl_{14}$ (139—141°/15 mm.), $Si_7O_6Cl_{16}$ (145—147°/15 mm.), $Si_3O_3(OEt)_8$ (268—273°), $Si_4O_3(OEt)_{10}$ (290—295°), $Si_6O_5(OEt)_{14}$ (300—310°). W. R. A.

Preparation and allotropic transformation of lead monoxide. M. Petersen (*J. Amer. Chem. Soc.*, 1941, **63**, 2617—2620).—Yellow, orthorhombic PbO is obtained on dehydration of PbO,xH_2O in a vac. at ~120° or on decomp. of $PbCO_3$ in a vac. at ~250°. In both instances the yield is dependent on the state of the original compound and is greatest when the original compound is of small particle size. With coarse particles red, tetragonal PbO is obtained. The boundary between red and yellow stability is 489±1°. From *X*-ray powder patterns the lattice dimensions of yellow PbO are: *a* 5·476, *b* 4·744, *c* 5·885 A. W. R. A.

Reactions of chromates at high temperatures. XIII. Decomposition of mixtures of calcium chromate with magnesium oxide. XIV. Decomposition of mixtures of strontium chromate with magnesium oxide. XV. Decomposition of mixtures of calcium chromate with calcium oxide and with calcium carbonate. XVI. Decomposition of mixtures of strontium chromate with strontium oxide and with strontium carbonate. XVII. Decomposition of mixtures of calcium chromate with ferric oxide and with chromic oxide. XVIII. Decomposition of mixtures of strontium chromate with calcium oxide and of calcium chromate with strontium oxide. XIX. Synthesis and decomposition of calcium chromate. XX. Synthesis and decomposition of strontium chromate. D. S. Datar (*J. Indian Inst. Sci.*, 1941, **23**, **A**, 237—250, 251—257, 258—268, 269—273, 274—282, 283—290, 291—309, 310—316; cf. A., 1940, I, 36 and previous abstracts).—XIII. A mixture of $CaCrO_4$ (1 mol.) with MgO (0·5 mol.) decomposes above 825° giving $2CaO,MgO,2CrO_3$, and then in successive stages $8CaO,4MgO,Cr_2O_3,6CrO_3$, $6CaO,3MgO,Cr_2O_3,4CrO_3$, $10CaO,5MgO,2Cr_2O_3,6CrO_3$, and $4CaO,2MgO,Cr_2O_3,2CrO_3$, at 25, 33·3, 40, and 50% decomp., respectively. The initial product is very stable and has no measurable O_2 pressure at the decomp. temp. of the corresponding basic chromate with Na_2O in place of MgO. Mixtures with a higher or lower proportion of MgO give the same products up to 50% decomp. Heats of decomp. corresponding with the several stages are calc. from the decomp. pressures.

XIV. Similar details are given for $2SrCrO_4 + MgO$ mixtures, which give analogous products at the corresponding stages.

XV. $CaCrO_4$ combines with CaO to form both $3CaO,CrO_3$ and $2CaO,CrO_3$; with $CaCO_3$ the former is the main product, but the latter is also formed to some extent.

XVI. Similar results are obtained with $SrCrO_4$ and SrO or $SrCO_3$. $2SrO,CrO_3$ decomposes completely without forming intermediate compounds. With both the Ca and Sr compounds $3MO,2CrO_3$ gives on decomp. $12MO,Cr_2O_3,6CrO_3$, $9MO,Cr_2O_3,4CrO_3$, and $15MO,2Cr_2O_3,6CrO_3$ in successive stages.

XVII. Addition of Fe_2O_3 accelerates the decomp. of $CaCrO_4$. The basic chromate formed, CaO,Fe_2O_3,CrO_3, decomposes to give $2CaO,2Fe_2O_3,Cr_2O_3$, which is the final product, without intermediate stages. Mixtures of $CaCrO_4$ with Cr_2O_3 behave similarly.

XVIII. Mixtures of $CaCrO_4$ with SrO and of $SrCrO_4$ with CaO both yield CaO,SrO,CrO_3, but whereas the second mixture gives rise to mixed basic Cr chromates of Ca and Sr, the first does not, although it can do so if $SrCO_3$ is substituted for SrO. Thermochemical data are recorded.

XIX. The oxidation of mixtures of Cr_2O_3 (1 mol.) with CaO (1, 2, 3, and 4 mols.) has been followed by measuring the O_2 absorbed and the equilibrium O_2 pressures produced at various stages. The reactions are $Cr_2O_3 + 3CaO \rightarrow 3CaO,Cr_2O_3 \rightarrow 6CaO,Cr_2O_3,2CrO_3 \rightarrow 15CaO,2Cr_2O_3,6CrO_3 \rightarrow 9CaO,Cr_2O_3,4CrO_3 \rightarrow 12CaO,Cr_2O_3,6CrO_3 \rightarrow 12CaO,8CrO_3 \rightarrow CaCrO_4$ with CaO and $2CaO,CrO_3$ if CaO was in excess, or CaO,Cr_2O_3,CrO_3 if Cr_2O_3 was in excess. The intermediate compounds, identified by their decomp. pressures, are thus identical with those occurring during the decomp. of $CaCrO_4$; variation in the proportion of CaO affects only the final product. Addition of MgO has no effect on the oxidation of Cr_2O_3 in presence of CaO. Tables of decomp. pressures and thermal effects are given. The basic chromate formed in the thermal decomp. of $CaCrO_4$ is due to a side reaction, the main reaction, $2CaCrO_4 \rightarrow 2CaO,Cr_2O_3 + 1{\cdot}5O_2$, being irreversible.

XX. Oxidation of Cr_2O_3 (1 mol.) with $SrCO_3$ (3 mols.) proceeds through a series of basic Cr chromates to the final product which contains $2SrO,CrO_3$ and $3SrO,2CrO_3$. In the decomp. of $SrCrO_4$, in addition to $2SrO,Cr_2O_3$, which is formed irreversibly at 1030°, the existence of three other basic chromites is indicated. In contrast to the behaviour of $CaCrO_4$, addition of Cr_2O_3 suppresses the decomp. of $SrCrO_4$ by producing SrO,Cr_2O_3,CrO_3, which forms a stable solid solution with $3SrO,2CrO_3$. F. L. U.

Products obtained by the reducing action of metals on salts in liquid ammonia solution. VI. Reduction of nickel salts. W. M. Burgess and J. W. Eastes (*J. Amer. Chem. Soc.*, 1941, **63**, 2674—2676).—When $NiCl_2$, $NiBr_2$, NiI_2, $Ni(CNS)_2$, $Ni(OAc)_2$, and $Ni(CN)_2$ are reduced by Na, K, or Ca in liquid NH_3 free Ni, in a finely-divided state, is first formed and is a very active catalyst for the reaction between Na, K, or Ca and NH_3. The Ni is pyrophoric owing to adsorbed H_2. The catalytic activity is greatest when the Ni is prepared using Ca. Small amounts of Ni amide are formed in presence of excess of Ni salt. W. R. A.

Preparation and properties of phthiocol inner complexes.—See A., 1942, II, 146.

X.—ANALYSIS.

Polarographic analysis. A. C. Coates and R. Smart (*Chem. and Ind.*, 1941, 778—784).—A review. The methods of polarographic analysis and the recording and interpretation of the polarograms are described, with particular reference to metallurgical analysis. J. W. S.

Naming spectroscopic analytical methods. M. G. Mellon (*J. Opt. Soc. Amer.*, 1941, **31**, 648—650). O. D. S.

Luminol as reagent for hydrogen peroxide, copper, iron, and cyanide. A. Steigmann (*J.S.C.I.*, 1942, **61**, 36).—The glowing of solutions of luminol (*o*-aminophthalhydrazide) containing $Na_2S_2O_3$, which is caused by traces of H_2O_2, is a very sensitive reagent for H_2O_2 at great dilutions. This reaction may be used to detect traces of Cu, Fe$^{\cdot\cdot}$, CN$'$, and Cu and Fe inhibitors in gelatins etc.

Determination of small quantities of fluoride in water. Modified zirconium-alizarin method. W. L. Lamar and C. G. Seegmiller (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 901—902).—Dil. H_2SO_4 is added to the H_2O, and thereby decreases interference due to SO_4'' to an extent such that waters containing <500 p.p.m. of SO_4'' may be analysed for F$'$ without recourse to a correction curve. Alkalinity in the H_2O is neutralised by means of HNO_3. The Zr$''''$–alizarin indicator appears to be more stable in dil. H_2SO_4 than in HCl or in a mixture of dil. HCl and H_2SO_4. When a 100-ml. sample is used, the F$'$ content of waters containing <500 p.p.m. of SO_4'', 500 of HCO_3', and 10^3 of Cl$'$ can be determined to within $\pm 0{\cdot}1$ p.p.m. L. S. T.

Quantitative analysis of mixtures of thiosulphate and sulphite. K. G. A. Pankhurst (*Chem. and Ind.*, 1942, 74—75).—In the iodometric determination of $Na_2S_2O_3$ and Na_2SO_3, aq. $BaCl_2$ can be used to remove SO_3'' if the p_H of the solution is adjusted first to $\sim 8{\cdot}6$ by means of $NaHCO_3$. L. S. T.

Rapid determination of hydrogen sulphide and mercaptan-sulphur in gases and aqueous solutions.—See B., 1942, I, 121.

Determination of pyritic sulphur in coal.—See B., 1942, I, 118.

Spectrographic analysis of iron for tellurium. R. E. Nusbaum and J. W. Hackett (*J. Opt. Soc. Amer.*, 1941, **31**, 620—626).—The determination of 0·001—0·01% Te in Fe is described. O. D. S.

Determination of silicon in aluminium and its alloys.—See B., 1942, I, 159.

Determination of small quantities of sodium in aluminium metal.—See B., 1942, I, 159.

Controlling factors in the assay of silver by cupellation.—See B., 1942, I, 158.

Spectrographic studies of co-precipitation. Fourth-period elements with barium sulphate, and copper and zinc with lead sulphate. L. Waldbauer, F. W. Rolf, and H. A. Frediani (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 888—889).—Data showing the co-pptn. of Fe$'''$, Mn$''$, and Cr$'''$ with $BaSO_4$, pptd. by addition of SO_4'' to acidified aq. $BaCl_2$ + foreign ion, are recorded. The wts. of ppts. are $<$ the theoretical, indicating that some phenomenon other than adsorption takes place. Co$''$ and Ni$''$ do not co-ppt. with $BaSO_4$ under the conditions described. Cu$''$ and Zn$''$ are co-pptd. with $PbSO_4$ obtained by adding SO_4'' to a dil. HNO_3 solution of $Pb(NO_3)_2$ + foreign ion. The data for Zn indicate the possibility of mixed crystal formation, whilst those for Cu indicate adsorption, occlusion, or post-pptn. L. S. T.

Quantitative spectrographic analysis of magnesium alloys.—See B., 1942, I, 159.

Gravimetric, colorimetric, and spectral analytical processes for the determination of small amounts of cadmium, copper, iron, and lead in zinc. W. Müller and A. Sieverts (*Spectrochim. Acta*, 1940, **1**, 332—351).—A gravimetric method of determining small amounts of Cd, Cu, Fe, and Pb in Zn described involves successive separation of Fe as $Fe(OH)_3$ (determined with 8-hydroxyquinoline), Pb as $PbCrO_4$ (determined with thionalide), Cu with thionalide, and Cd by internal electrolysis, using Zn foil and Pt gauze (determination with β-naphthoquinoline and KI). Colorimetric methods for determining Fe with sulphosalicylic acid and Cu, Cd, and Pb with dithizone are detailed. Spectroscopic determinations are best made by comparison of the intensities of the Cd 2265, Cu 3247·5, Pb 2203·5, and Fe 2382 A. lines with the Zn 2064·2 or 2102·88, 3282·3, 2102·88, and 2502 A. lines, respectively. Sensitised plates are required for the determination of Cd and Pb. The results of determinations by the three methods are in satisfactory accord. J. W. S.

Rapid determination of copper in its alloys.—See B., 1942, I, 156.

Titrimetric determination of copper in mineral oils.—See B., 1942, I, 125.

Photometric determination of minute amounts of mercury. A. E. Ballard and C. D. W. Thornton (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 893—897).—Hg$''$ is recovered completely by passing the solution through an asbestos pad impregnated with CdS and supported on a sintered-glass disc. The dried pad containing HgS is heated in a closed system in a quartz-ended cell, and the absorption of 2537 A. measured photometrically to determine the amount of Hg present. Details of apparatus and performance are given. 0·02—0·60 $\pm$ 0·02 μg. of Hg$''$ in 150—400 c.c. of solution can be determined. Hg$''$ is adsorbed by glass from dil. solution. L. S. T.

Molecular spectra and fractionation of rare earths. G. Piccardi (*Spectrochim. Acta*, 1939, **1**, 249—269).—A visual spectro-chemical method has been applied to the determination of rare earths. The oxides are excited in a gas flame and from the intensities of the emitted bands Sc, Y, La, Gd, Sm, and Eu can be detected and determined. During the separation of a mixture of rare-earth bromates the analytical method revealed two new band spectra, one of which was probably due to DyO. C. R. H.

Spectrochemical determination of scandium in silicate rocks. A. Kvalheim and L. W. Strock (*Spectrochim. Acta*, 1939, **1**, 221—226).—The method used is a combination, by a simple procedure, of the sensitive cathode layer method and a photometric determination of photographic spectral line densities. The Sc lines 4246·83, 4320·73, and 4314·09 A., especially the first, are well suited as analysis lines. 1% of La_2O_3 is added to the standard mixture and samples so as to act as an internal intensity standard, the La line 4263·59 A. being compared with the first Sc line and the La line 4322·51 A. with the second and third Sc lines. The construction of a calibration curve is described. The Sc content of five pyroxenites and one kimberlite has been determined. C. R. H.

Spectro-analytical determination of elements in flame and spark by direct photo-electric measurement of line intensities. G. Thanheiser and J. Heyes (*Spectrochim. Acta*, 1939, **1**, 270—288).—The relative advantages of flame and spark technique are discussed. An apparatus in which the light emanating from a spark is separated into two parts by a system of prisms is described. Both parts are examined by a monochromator, the intensities being measured by two photo-cells which operate two electrometers. The ratio of the charges on the electrometers at any given time $\propto$ the ratio of line intensities. Given the line intensity for known concns. of element, the element concn. in other cases can be calc. Results for Al containing Mn and Mg illustrate the application of the method, the accuracy of which is $\sim 1{\cdot}5\%$. C. R. H.

Potentiometric determination of nickel and copper in steel.—See B., 1942, I, 154.

Determination of molybdenum in alloy steels.—See B., 1942, I, 154.

Determination of tin in cast iron and plain steel.—See B., 1942, I, 150.

Determination of small amounts of antimony with rhodamine B. W. G. Fredrick (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 922—924).—The Sb dissolved in 25% H_2SO_4 is oxidised to Sb^V by means of $Ce(SO_4)_2$ in presence of Cl' (from LiCl), and the red complex obtained with rhodamine B (I) is extracted with EtOH after destruction of excess of reagent by means of aq. Br. The determination is then made colorimetrically. Most acids radicals, except Cl' and SO_4'', interfere. Metals of the dithizone (II) group, *e.g.*, Hg, Cu, Ni, Cd, and Zn must first be extracted with (II) at p_H 8·5. As and Fe also interfere. The method detects 0·1 μg. of Sb^V in 5 ml. of solution. Procedure for determining 0·1—300 μg. of Sb, and precautions to be observed in using the method, are described. The reaction of (I) and Sb oxidised with $NaNO_2$ in the solution could not be developed quantitatively. The 25% H_2SO_4 is preferable to 50% HCl for the colorimetric determination. The colour produced by dissolution of the Sb–(I) complex in EtOH follows Beer's law. Data showing the accuracy of the method are recorded. L. S. T.

Separation of bismuth from lead with ammonium formate. S. Kallmann (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 897—900).—Benkert and Smith's basic formate method (A., 1897, ii, 435) has been investigated critically. It does not give a clear-cut separation of Bi from Pb, especially when large amounts of Pb are involved and only two formate separations are employed. A modification of the method in which close attention is paid to conditions of neutralisation, and NH_4 replace Na salts, in which basic Bi formate (I) is slightly sol., is described. The modified method is satisfactory even when small amounts of Bi are separated from 10—50 g. of Pb. The (I) obtained can be ignited to Bi_2O_3, or dissolved in HCl and the Bi pptd. as BiOCl, or dissolved in dil. H_2SO_4 and the Bi (≯0·7 mg.) determined colorimetrically by means of KI. Pb is pptd. as chromate in the filtrate from (I). Data concerning the separations to be obtained by these methods, and the solubility of (I) and basic Bi carbonate in the filtrates from their respective pptns., are recorded. L. S. T.

Photometric determination of niobium and tantalum in steel etc.—See B., 1942, I, 154.

XI.—APPARATUS ETC.

Modified heat-conduction calorimeter. W. T. Ziegler and C. E. Messer (*J. Amer. Chem. Soc.*, 1941, **63**, 2694—2700).—Constructional and operational details are given of a heat-conduction calorimeter suitable for studying the thermal properties of substances which undergo λ-type transition. KCl was used as a standard substance. Vals. of C_p from 107° to 321° K. are given for $KClO_3$, NH_4Cl, and $(NH_4)_2SO_4$. The transition temp. for NH_4Cl is −30·6±0·15° and for $(NH_4)_2SO_4$ −49·9±0·15°. The entropy of NH_4Cl at 298° K. is 22·6±0·3 g.-cal. per degree per mol. W. R. A.

Two bridge-controlled thyratron thermostats. D. Bancroft (*Rev. Sci. Instr.*, 1942, **13**, 24—27).—Two circuits for the regulation of temp. by means of a bridge-controlled thyratron are described. One utilises a resistance thermometer, whilst the other controls through changes in the resistance of the furnace winding. Extreme overload in control voltage does not cause erratic behaviour. A. A. E.

Response of sputtered thermocouples to interrupted radiation. L. Harris and A. C. Scholp (*J. Opt. Soc. Amer.*, 1940, **30**, 519—522).—The response of thin sputtered thermocouples to interrupted radiation of frequencies down to 0·75 cycle per sec. has been investigated for Bi–Sb and Bi–Te couples. The attenuation factors for different frequencies are evaluated from the voltages generated by the couples. Experimental results agree satisfactorily with theory for Bi–Sb couples, but not for Bi–Te couples, which are anomalous. Thin sputtered thermocouples when used with low-frequency amplification are more sensitive than wire thermocouples used with the most sensitive galvanometer but without mutipliers. A. J. M.

Increasing the depth of focus in photomicrography by incident light. W. Koch (*J. Roy. Microscop. Soc.*, 1941, **61**, 86—87).—Depth of focus can be increased by inserting a stop immediately above the coverslip. E. E. H.

Automatic time-switch apparatus for spectral photographs. G. Balz and G. Reiniger (*Spectrochim. Acta*, 1940, **1**, 323—331).—The advantages of automatic control of the time the spark is allowed to pass before its spectrum is photographed and of the exposure time are discussed. An electrically operated time switch arrangement for this purpose is described. J. W. S.

Simple device for increasing photographic plate capacity for spectra in the technical analysis of alloys. G. Balz (*Spectrochim. Acta*, 1939, **1**, 227—228).—Half of the photographic plate is shielded so that the unused portion of the spectrum is not photographed. The plate is then reversed and the unused portion used for a subsequent analysis. C. R. H.

Photography by luminescent screens in the extreme ultra-violet. T. Suga and M. Kamiyama (*J. Opt. Soc. Amer.*, 1941, **31**, 592—593).—An ordinary fast emulsion placed in contact with a film of $CaWO_4$, $MgWO_4$, Zn or Cd silicate, or Cd borate gives satisfactory spectrograms of the He continuum and emission lines at ~230—1000 A. The spectrograms are less sharp than those obtained with Schumann plates, and longer exposures are required. The method may be suitable for photometric measurements in the extreme ultra-violet. A. J. E. W.

Determining chromatic aberration for photomicrographic purposes. W. Koch (*J. Opt. Soc. Amer.*, 1940, **30**, 564—565).—The simple method described enables the difference of focus of a lens for different λλ to be determined by a single test exposure. The method is based on the photographing of a stage micrometer in an oblique position in the light of different λλ and reading the difference of focus from the division marks of the micrometer. The process is best carried out with a microscope with a mechanical stage. A. J. M.

Spectrographic analysis. Photographic aspects of the internal standard method. I. A. C. Coates and E. H. Amstein (*J.S.C.I.*, 1942, **61**, 21—29).—The method is considered in which plate calibration is carried out using metallic pencils of known composition, and the calibration curve is a log plot of concn. against the opacity ratio of the standard to the impurity line. The general equation for this calibratiou curve is derived, and from it the following are deduced: (1) the quant. effect of a difference in λ between standard and impurity lines; (2) the slope of the calibration curve; (3) the significance of the useful exposure range, and (4) the reasons for plate calibration. The photographic consts. are determined, using as a const. source a hot Hg arc, and varying the exposures. In this connexion the effect of reciprocity failure is discussed. Some practical analyses are considered in the light of the above theoretical results, using the determined photographic consts. Two processes for duralumin are compared, and as a further example the estimation of Cu and Sb in an alloy is considered.

Loss of light in spectrographs with very narrow slits. G. Milazzo and G. B. Tommasi (*Spectrochim. Acta*, 1939, **1**, 229—238).—The drop in intensity of spectral lines as the width of the slit is reduced is discussed theoretically. Loss of light may be due, among other things, to diffraction effects at the slit, optical image distortion, and the effect of emulsion graininess in the photographic plate. The effect of diffraction can be calc. from Fresnel's formulæ; the other effects must be determined experimentally. The plot of light loss against slit width has the same form irrespective of the cause of the loss. C. R. H.

Projection comparator for spectro-chemical analysis. A. Gatterer (*Spectrochim. Acta*, 1940, **1**, 352—373).—Details are given of an improved and more convenient form of the comparator previously described (*Z. Instrumk.*, 1938, **58**, 271). The new apparatus enables enlargements of spectral photographs, taken on different plates, to be cast side by side on a screen, photographed together, or compared by means of a photo-cell. J. W. S.

Tempering effect in spectral analysis. H. Mäder and R. Poetzelberger (*Spectrochim. Acta*, 1939, **1**, 213—220).—Several causes, *e.g.*, melting and oxidation phenomena at the metal surface, and internal state of the alloy, contribute to the delay observed in the line intensities becoming const. This is particularly noticeable in Al–Mg alloys. The behaviour on spark heating of alloys containing constituents of widely differing m.p. is discussed. The more volatile constituent of the alloy is removed rapidly, thus enriching the residual metal in the less volatile constituent. C. R. H.

Method of spectrophotometry for solutions in liquified gases.—See A., 1942, I, 82.

Evaluation of *X*-ray back-reflexion pictures. H. Neerfeld (*Mitt. Kaiser-Wilh.-Inst. Eisenforsch.*, 1940, **22**, 213—216; *Bull. Iron Steel Inst.*, 1941, No. 71, 38A).—Methods of evaluation are reviewed and modifications which simplify the procedure proposed. A suggested procedure for rapidly determining the lattice const. is to project the *X*-ray film on to a suitable nomogram. A more accurate method is measurement of the distance between the lines with a glass rule or a comparator in the usual way and the use of a nomogram, or a special slide rule, to simplify the calculation of the lattice const. R. B. C.

Prism and sector photo-electric photometers for determination of concentrations in gaseous or liquid systems. L. Harris, J. A. Kyger, and C. N. Sjogren (*J. Opt. Soc. Amer.*, 1941, **31**, 263—267).—Two photometers for the accurate determination of concns. from transmission measurements are described. The original monochromatic light from an at. spectral source is divided into two beams, one of which is incident on one photo-tube. The other beam passes

through the photometer and the absorption cell, and then reaches the second photo-tube. The photometer is adjusted until the two photo-tube currents are equal. A. J. M.

Microphotometer. H. B. Vincent and R. A. Sawyer (*J. Opt. Soc. Amer.*, 1941, **31**, 639—643).—A photometer suitable for routine measurement is described in detail. O. D. S.

Optical properties of the grating interferometer. J. H. Schroeder and B. P. Ramsay (*J. Opt. Soc. Amer.*, 1940, **30**, 355—361).—A grating interferometer, made by substituting gratings for mirrors in the arms of a Michelson interferometer, may be useful for the study of fine structure. The order of interference, resolving power, magnifying power, and dispersion of the arrangement are discussed. A. J. M.

Fabry–Perot interferometers in a parallel arrangement. L. Sturkey (*J. Opt. Soc. Amer.*, 1940, **30**, 351—354).—The intensity equation of an arrangement consisting of two Fabry–Perot interferometers in parallel is obtained and discussed. The arrangement may be applied to spectroscopic work. A. J. M.

Use of the interferometer in analysis of mine gases.—See B., 1942, I, 121.

Reflectometers.—See B., 1942, I, 109.

Low-reflexion evaporated fluoride coatings. G. S. Monk (*J. Opt. Soc. Amer.*, 1940, **30**, 571—572).—Low-reflecting films of fluorides on glass are in the liquid phase when first deposited, but become solid within 24 hr. When lenses are coated with low-reflecting fluoride films there is a considerable improvement in the transmission as a function of λ. A. J. M.

Field emission *X*-ray tube. C. M. Slack and L. F. Ehrke (*J. Appl. Physics*, 1941, **12**, 165—168).—Currents of several thousand amp. can be obtained in highly evacuated tubes by the application of high field gradients to cold metallic electrodes. This principle has been applied in the construction of a condenser discharge *X*-ray tube for taking radiographs of rapidly moving objects. A third electrode is placed close to the cathode and connected to the anode through a high resistance. This initiates the discharge, which is then forced, by the voltage drop across the high resistance, to transfer to the anode. If correctly shaped, the auxiliary electrode may be used to focus the electrons on the desired region of the anode. A. J. M.

Application of the microscope in forensic science.—See A., 1942, III, 279.

300-kilovolt magnetic electron microscope. V. K. Zworykin, J. Hillier, and A. W. Vance (*J. Appl. Physics*, 1941, **12**, 738—742).—A modified form of the R.C.A. commercial electron microscope is briefly described. Typical photomicrograms of blood smears, *B. megalherium*, and a cut section (1—2 μ. thick) of cockroach skin are reproduced; the last-named clearly shows internal structure. The high accelerating potential results in high penetrating power, but renders the adjustment of the apparatus very crit.; Pb screens are required to eliminate stray *X*-rays produced by the electron beam. A. J. E. W.

Determination of object thickness in electron microscopy. L. Marton and L. I. Schiff (*J. Appl. Physics*, 1941, **12**, 759—765).—Theory is given for a method of determining the thickness from the reduction of electron beam intensity caused by the object. With thin objects this reduction is calc. from the total cross-section for single scattering of electrons outside the aperture of the microscope objective; the cross-section for electrons of energy <10 kv. is determined by the Born approximation. The effects of multiple scattering and of free-electron scattering in metals are discussed. Typical applications to the determination of the thickness of grains in Sb films, Na laurate curd fibres, and gelatin or collodion " casts " of metallographic specimens, are described. A. J. E. W.

Current–potential curves in ionised gas flames. T. Heumann (*Spectrochim. Acta*, 1940, **1**, 293—318).—The influence of the length, thickness, temp. and nature of the probe electrode on the variation of the current with the p.d. applied between the burner and a probe electrode has been investigated for a Bunsen flame. The form of the curve depends only on the cathode and its characteristic is attributed to the cool film on the probe electrode in which recombination of ions and combination of electrons with mols. occurs, thereby increasing the electron velocity. When two probe electrodes are introduced into the flame there is a potential fall at each electrode and no potential gradient in the main body of the flame. A Bunsen flame at 2000° K. contains 10^7—10^8 charged particles per c.c. J. W. S.

Electrode polarisation. IV. Automatic control of potential of a working electrode. A. Hickling (*Trans. Faraday Soc.*, 1942, **38**, 27—33; cf. A., 1941, I, 470).—An electrical device is described whereby the potential of a working electrode, relative to that of a reference electrode, can be maintained automatically at any desired val. If no electrode process is possible at this val. no current will pass through the cell; if some electrolytic process is possible the limiting current for that process will pass. Applications of the method are described. F. L. U.

Measurement of dielectric constants by the comparison method. Dielectric constant of carbon tetrachloride from 15° to 40°. J. G. Miller (*J. Amer. Chem. Soc.*, 1942, **64**, 117—121).—A scheme of capacity measurements at varying frequencies has been applied to the comparison method of determining dielectric const. (ϵ). Vals. of ϵ for CCl_4 at six temp. between 15° and 40° are given. W. R. A.

Method of minimising supercooling and its application in the determination of freezing points from dielectric constant measurements. T. M. Shaw (*Rev. Sci. Instr.*, 1942, **13**, 2—5).—In the study of the freezing and thawing of H_2O in soils and other colloidal materials by determination of ϵ at temp. $>$ and $<$ the f.p. supercooling prevents precision. The condenser described includes in the outer electrode a device which permits the cooling of a very restricted portion of the soil. With the procedure described, supercooling is negligible. A. A. E.

Hydrogen arc of high intensity for continuous ultra-violet radiation. A. J. Allen (*J. Opt. Soc. Amer.*, 1941, **31**, 268—270).—The construction of the apparatus is described. A. J. M.

Ion beam focussing. W. W. Buechner, E. S. Lamar, and R. J. Van de Graaff (*J. Appl. Physics*, 1941, **12**, 141—148).—The initial focussing of ions from capillary sources of the diffusion type is considered. The first lens of the focussing system was formed by a cylindrical electrode coaxial with a 90° cone, from the apex of which the ions drifted out from the source. This was followed by two other coaxial cylinders at various potentials up to 25 kv. An electric scanning method was used to examine the beams. They were also studied by a photographic method as they were made slightly luminous by traces of gas in the high-vac. region. A focussing and canal arrangement suitable for differential pumping is described, and incorporated in an ion gun assembly. A. J. M.

Photo-electric measurement of scale marks and spectrum lines. G. R. Harrison and J. P. Molnar (*J. Opt. Soc. Amer.*, 1940, **30**, 343—347).—A new type of all-electric balancing network for photometric work is described. With it a single photo-cell or electron multiplier can be used to locate accurately and rapidly the centre of a spectrum line or scale mark. The positions of 4000 lines can be recorded in <2 min. A. J. M.

Optimum liquid combinations for cloud chambers. C. Beck (*Rev. Sci. Instr.*, 1941, **12**, 602—606).—A mixture of Pr^{n}OH 50, $COMe_2$ 25, and H_2O 25 vol.-% has a satisfactory expansion ratio and gives excellent tracks with low background fog. Photochemical fog is caused chiefly by light of $\lambda<3900$ A. Irradiation of pure alcohols gives no perceptible fog, but that of the above mixture produces dense fog. However, if illumination is of short duration photolytic action is small and the decay of photo-chemical nuclei is sufficiently rapid. A. A. E.

Theory of the cyclotron. R. R. Wilson (*J. Appl. Physics*, 1940, **11**, 781—796).—The formation of the initial ions in the cyclotron and the various processes leading to the loss of ions from resonance are discussed in detail. Theoretical predictions are compared with experimental data for the Berkeley 37- and 60-in. cyclotrons. It is suggested that the best form of magnetic field for the cyclotron is that in which the field decreases from the centre with const. dH/dr. Methods of obtaining such a field are described. O. D. S.

Developments in ion accelerating tubes. J. H. Manley, L. J. Haworth, and E. A. Luebke (*Rev. Sci. Instr.*, 1941, **12**, 587—590).—A stable artificial neutron source which is suitable for the production of neutron bursts of variable frequency and length is described. By the use of the D–D reaction, target currents of >200 μa. at 300 kv. give a neutron yield of 10 g. Ra–Be equiv. A. A. E.

Absolute sensitivity of Geiger counters. J. D. Craggs (*Nature*, 1941, **148**, 661).—Preliminary experiments with single β- and γ-ray counters for determining the abs. yields of some nuclear disintegration processes are described, and possible errors discussed. L. S. T.

Comparison between a Geiger–Müller counter, a secondary electron multiplier tube, and a photographic film for detecting weak *X*-rays. A. Eisenstein and N. S. Gingrich (*Rev. Sci. Instr.*, 1941, **12**, 582—586).—The tube has a lower resolving time than the counter, but the sensitivity of the latter is 5—10 times that of the former. The tube sensitivity increases with λ more rapidly than the counter sensitivity. A diffraction pattern of a liquid can be obtained with a counter in $\frac{1}{20}$ of the time required for a photographic exposure. A. A. E.

Circuit for self-recording Geiger–Müller counters. L. Jánossy and P. Ingleby (*J. Sci. Instr.*, 1942, **19**, 30—31).—A circuit suitable for recording which of a set of Geiger–Müller counters are discharged simultaneously with the coincidences of a set of master counters is described and figured. The resolving time of the circuit is $\sim10^{-4}$ sec., and its efficiency to record counter discharges is $<99\%$. A. A. E.

Apparatus for the direct determination of slow neutron velocity distributions. L. J. Haworth, J. H. Manley, and E. A. Luebke (*Rev. Sci. Instr.*, 1941, **12**, 591—597).—By means of the apparatus

described, with a detailed circuit diagram, a modulated source of slow neutrons can be produced and their intensity determined as a function of time. Deflexion of the deuteron beam of a high-voltage tube affords square bursts of neutrons of any desired length. After being slowed by paraffin a beam falls on a detector, pulses from which are impressed on an oscilloscope screen together with a time scale. A. A. E.

Apparatus for analysis of 1 ml. of respiratory gas.—See A., 1942, III, 297.

Rotating bubble method for the determination of surface and interfacial tensions. B. Vonnegut (*Rev. Sci. Instr.*, 1942, **13**, 6—9).—The two phases in a closed container are rotated at a known speed about a horizontal axis. The lighter phase takes the equilibrium shape of an elongated bubble along the axis of rotation. If the length of the bubble is large in comparison with its radius, γ can be computed from the radius, the densities of the phases, and the angular velocity. A preliminary approx. determination of γ for liquid Wood's metal at the m.p. gave the val. 250 dynes per cm. A. A. E.

Explorations toward the limit of utilisable pressures. P. W. Bridgman [with A. B. Greninger and L. A. Carapella] (*J. Appl. Physics*, 1941, **12**, 461—469).—Experiments are described in which Carboloy bosses, immersed in *iso*-C_5H_{12} at a hydrostatic pressure of 26,000 kg. per sq. cm., were subjected to additional compressive stresses $>$360,000 kg. per sq. cm. Although Carboloy is normally brittle, appreciable plastic flow occurs at such pressures. Total pressures (p kg. per sq. cm.) of 300,000—400,000 produced no permanent allotropic change, as shown by X-radiograms, in graphite, S, Se, black P, Tl, In, or Sn. The measurement of compressibility at p = 100,000—150,000 is discussed, with special reference to the choice of piston material. Carboloy (No. 905) under hydrostatic pressure has a compressive strength ($\sim$125,000 kg. per sq. cm.) $>$ that of steel, quartz, spinel, sapphire, or tourmaline, and approx. equal to that of diamond. A. J. E. W.

Fine fractionating column constructed entirely of glass and employing multi-chamber tubes. K. Klein, H. Stage, and G. H. Schultze (*Z. physikal. Chem.*, 1941, **A**, **189**, 163—170).—Recent types of fractionating columns are discussed and a new column employing four-chamber tubes having an efficiency equiv. to 10 theoretical plates over a height of 62 cm. is described. C. R. H.

Filtration aids. J. Carey (*Pharm. J.*, 1942, **148**, 42).—Two simple devices for maintaining a const. level of solution in the filter funnel and also of the H_2O when washing the ppt. are described. D. F. R.

Use of a McLeod gauge in measuring small volumes. N. B. Keevil, R. F. Errington, and L. T. Newman (*Rev. Sci. Instr.*, 1941, **12**, 609—611).—Precautions necessary for accurate vol. measurements are discussed. Vals. of the capillary depression of Hg, determined as the intercept on the p' axis of the plot of the apparent pressure difference p' against the reciprocal of the length of the gas column, are not const. Hence vals. of He contents of rocks and meteorites, based on the assumption of a const. depression, need review. A. A. E.

Electrical capacitance diaphragm manometer.—See A., 1942, III, 296.

Two improved pressure-regulation devices. J. H. Thelin (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 908—910).—The regulators described and illustrated give sensitive pressure control over the ranges 1—200 and 1—350 mm., respectively. They have been designed for experiments on the v.p. of binary mixtures. L. S. T.

Preparation of thin potassium foils. J. B. Platt and D. H. Tomboulian (*Rev. Sci. Instr.*, 1941, **12**, 612—613).—Protected K films, $\sim 8 \times 10^{-4}$ cm. thick, were made by evaporating Al on to a cleaned Kodapak surface, then evaporating K on to the Al from an externally heated crucible (using C_6H_6 instead of kerosene for protection), and finally evaporating ceresin wax on to the K. No change was observed for 10 min. after removal from the vac. system. After transfer in $\frac{1}{2}$ hr. to an X-ray spectrometer $>$1% of the surface had deteriorated; at forevac. pressure the absorbers kept indefinitely without further change. A. A. E.

Sample carrier for organic liquids. F. O. Green (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 911).—The carrier is blown from Pyrex tubing, and has a small opening at one end. It is suitable for liquids of intermediate b.p. Loss by evaporation is eliminated, and the disadvantages of sealed bulbs are avoided. L. S. T.

Disposal of acid fumes in wet assaying. E. J. Poth and G. A. Elliott (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 910).—Fumes are rapidly and completely removed by passing the fume-laden gases over zeolite sand covered with H_2O. Large vols. of gas can be dealt with, and removal of acid fumes is so effective that any type of pump can be used with the exhaust open to the laboratory. Application of the procedure to micro-Kjeldahl digestion is illustrated. L. S. T.

Chromatography of solutions containing a single solute. H. G. Cassidy and S. E. Wood (*J. Amer. Chem. Soc.*, 1941, **63**, 2628—2630).—The chromatography of lauric acid on a C column is in satisfactory agreement with Wilson's theory (A., 1940, I, 370). W. R. A.

New form of chromatogram employing two liquid phases. I. Theory of chromatography. II. Application to micro-determination of higher monoamino-acids in proteins. A. J. P. Martin and R. L. M. Synge (*Biochem. J.*, 1941, **35**, 1358—1368).—I. A theory of chromatography, based on the theoretical plate concept and applicable to substances with linear distribution isotherms, is advanced. Chromatography is thus related to fractional distillation etc.

II. A new chromatogram, depending on partition of solutes between two liquid phases, is described. A SiO_2 gel column is thoroughly mixed with an aq. solution of Me-orange, and the substances for analysis are dissolved in $CHCl_3$ containing 0·5—1·0% of BuOH and poured on to the top. The position of the acids is revealed by the indicator, which turns from yellow through orange to pink. The NH_2-acids occurring in Merino wool hydrolysates are separated into three groups (as their Ac derivatives) from amounts of material corresponding with 30 mg. of protein, and the results agree well with those obtained by other methods. P. G. M.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Chemical processes in which solids participate. I. Historical foundations. G. F. Hüttig (*Kolloid-Z.*, 1941, **94**, 137—147).—A survey. F. L. U.

XIII.—GEOCHEMISTRY.

Changes taking place in sea-water during storage. H. W. Harvey (*J. Marine Biol. Assoc.*, 1941, **25**, 225—233).—Evidence is obtained that when a glass or SiO_2 capillary tube is dipped into sea-H_2O containing a trace of casein or peptone the org. matter is adsorbed on the tube at the meniscus. This supports the view that the rapid growth of bacteria when sea-H_2O is stored in glass vessels is brought about by concn. of food by adsorption. In the presence of glucose and an NH_4 salt the P consumed by bacteria is regenerated as PO_4''' after their death. Bacteria in sea-H_2O liberate PO_4''' readily from nucleic acid and casein but not from glycerophosphate. J. W. S.

Concentrated saline water from the Sturgeon River gold mines. E. L. Bruce (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 25—29).—The H_2O appears to have been impounded in the rocks; it is not H_2O that has seeped down from the surface. The salts consist of $CaCl_2$ (81·6%) and NaCl (18·4%) with traces of K^*, Mg^{**}, and SO_4''. L. S. T.

Piezo quartz. A. W. G. Wilson (*Canad. Chem.*, 1941, **26**, 10—14, 45).—An account of applications, properties, and occurrence in Canada.

Petrographic province of Central Montana. E. S. Larsen (*Bull. Geol. Soc. Amer.*, 1940, **51**, 887—948).—Variation diagrams for the various sub-provinces are reproduced and discussed. Chemical composition of the rocks is outlined. The parent magmas of the various provinces are represented probably by the mafic rocks, and were derived probably from a basaltic magma by the removal of crystals of calcic plagioclase and hypersthene in depth. L. S. T.

Origin of the hæmatite deposits at Steeprock Lake, Ontario. T. L. Tanton (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 131—140).—Glacially-transported boulders show that the hæmatite (I) is an integral part of a jaspilite-(I) deposit with the chemical and mineralogical composition of Fe formation such as characterises all Fe ranges in the Lake Superior region. The Steeprock (I)-bearing deposits appear to have emanated from an igneous source in a manner and by processes common to Fe formation, and to have risen through rock channels as in conduits. L. S. T.

Rock alterations by hydrothermal solutions in certain Canadian localities. E. L. Bruce (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 31—37).—Diagrams showing the alterations in chemical composition of porphyry, syenite, and lamprophyre from Kirkland Lake, Ontario, of granite from Orphan Mine, Sturgeon River area, Ontario, of basic lavas from Hollinger Mine, Porcupine, Ontario, and of basic lava to produce Fe formation, Goudreau, Ontario, are reproduced and discussed. Chemical analyses are recorded. L. S. T.

Crystalline morphology of microlite. J. D. H. Donnay (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 51—56).—Microlite (I) from Morefield mine, Amelia, Virginia, has morphology *Fd***, space-group O_h^7—*Fd*3*m*. (I) from Maine has $a_{calc.}$ 10·3 A. and $a_{obs.}$ 10·4 A. L. S. T.

"Lead-ratio" method for determining the age of the Deccan Traps. A. S. Kalapesi, S. K. Chhapgar, and R. N. Sukheswala (*Current Sci.*, 1941, **10**, 526—528).—The amounts of U, Th, and Pb in fresh specimens of igneous rocks from the Deccan Traps have been determined, and the age of the rocks has been calc. by the formula, age = (% Pb)/(% U + 0·36 × % Th) × 7600 × 10^6 years. A. J. M.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MAY, 1942.

I.—SUB-ATOMICS.

Spectro-analytical determination of elements in flame and spark by direct photo-electric measurement of line intensities.—See A., 1942, I, 154.

Spectrographic analysis. Photographic aspects of the internal standard method.—See A., 1942, I, 156.

Opposed axial orientation of atoms in an electric field. J. Stark (*Physikal. Z.*, 1941, **42**, 45—47).—Application of a strong coaxial electric field to He canal rays causes intensity dissymmetry in the displaced components of certain higher lines in the par-He series. $2P,p—mP,p$, $1s—mp$, and $2S—mP$ lines form doublets when the field is applied. It is inferred that He atoms, like H atoms (cf. A., 1938, I, 377), assume opposed axial orientations in an electric field. A. J. E. W.

Measurement by ionisation methods of real energy absorption from an *X*-ray beam. J. R. Clarkson (*Phil. Mag.*, 1941, [vii], **31**, 437—451).—Ionisation currents were measured at low pressure in gases contained in chambers having walls of several different metals, graphite, and "Elektron" alloy, for a narrow range of λλ. The electronic real energy absorption coeffs. measured from the slopes of the ionisation–pressure curves are < theoretical vals., except for substances of at. no. <12. L. J. J.

Elastic scattering of fast electrons by nitrogen nuclei. F. C. Champion (*Nature*, 1941, **148**, 727).—A discussion. Evidence is now strong that the N nucleus exhibits excess scattering of electrons at energies >1 Mv. L. S. T.

Distribution of energy among the cathode rays of a glow discharge. R. M. Chaudhri (*Nature*, 1941, **148**, 727—728).—Experiments to determine the energy distribution among electrons originating in the cathode dark space of the glow discharge through gases show that (i) at low pressures and high voltages where the discharge is abnormal, the issuing electrons are substantially homogeneous in energy, and (ii) at higher pressures and lower voltages, the electron beam possesses a wide range of energies; the general form of this energy distribution is independent of current and voltage. Except at the highest pressures, there is no support for the view that ionisation is uniform throughout the cathode dark space. L. S. T.

Space-charge effects in velocity-modulated electron beams. W. H. J. Fuchs and R. Kompfner (*Proc. Physical Soc.*, 1942, **54**, 135—150).—Mathematical. Two different mathematical models of velocity-modulated beams are constructed. The first model is applied to the study of drift tubes working as high-frequency amplifiers and conclusions are deduced and discussed. The second or "domain" model is devised so as to allow a simple analysis of the process of "bunching" in the presence of space charge. N. M. B.

Angular distribution of current from a point in hydrogen. W. H. Bennett (*Physical Rev.*, 1942, [ii], **61**, 53—56; cf. A., 1941, I, 66).—The angular distribution of current of electrons from a sharp point in H_2 was measured for various currents and sizes of wire. Evidence is obtained for the crit. effect of the potential drop in the ionisation sheath. N. M. B.

Ionisation of gases by collisions of their own accelerated atoms and molecules. H. W. Berry, R. N. Varney, and S. Newberry (*Physical Rev.*, 1942, [ii], **61**, 63—64; cf. A., 1936, 1041).—Apparatus for producing fast neutral atom beams with energies up to 8000 e.v. and measuring ionisation due to collisions is described. Preliminary results show that ionisation of A atoms appears to be similar to ionisation by electron collisions in that the efficiency reaches a peak and falls off again with increasing speed. Ionisation of N_2 by neutral N was observed but the efficiency was ≪ for A, and the nature of the ionisation function was not definitely established. This is the first evidence of ionisation of N_2 by collisions of heavier particles in the energy range < that of α-particles. N. M. B.

Current-potential curves in ionised gas flames.—See A., 1942, I, 157.

Isotope report, 1940. S. Flügge and J. Mattauch (*Physikal. Z.*, 1941, **42**, 1—5; cf. A., 1940, I, 185).—Mass, packing-fraction, and mass-defect data are tabulated for elements from H to V, and for ^{56}Fe, and evidence for changes is reviewed. Revised relative abundance data for Mo are given. A. J. E. W.

Production of 2·5 litres of the pure ^{22}Ne and ^{20}Ne.—See A., 1942, I, 152.

Direct determination of slow-neutron velocity distributions.—See A., 1942, I, 158—159.

Developments in ion accelerating tubes.—See A., 1942, I, 158.

Magnetic scattering of neutrons. M. Hamermesh (*Physical Rev.*, 1942, [ii], **61**, 17—18).—Discrepancies between theory and experiment in results previously reported (cf. A., 1941, I, 359) are removed by a recalculation of the form factor of the 3*d* shell of Fe, using Hartree functions for Fe instead of adjusted functions for Cu. N. M. B.

Single scattering of fast electrons. E. Bleuler, P. Scherrer, and W. Zünti (*Physical Rev.*, 1942, [ii], **61**, 95).—Elastic scattering of fast electrons (Ra-*B* + -*C*) by N, F, and A nuclei was investigated with a cloud chamber. The total scattering is somewhat > theoretically expected. The scattering cross-section as a function of energy and angle agrees with the predictions of theory. N. M. B.

Scattering of protons by deuterium. R. F. Taschek (*Physical Rev.*, 1942, [ii], **61**, 13—17).—Investigations in the energy interval 200—300 ke.v. and as a function of angle over 20—90° show that the ratio of observed scattering to that expected on Rutherford's formula differs appreciably from unity and increases with increasing energy and angle (cf. Tuve, A., 1937, I, 5). N. M. B.

Photo-disintegration of beryllium and deuterium. F. E. Myers and L. C. Van Atta (*Physical Rev.*, 1942, [ii], **61**, 19—22).—Thresholds redetermined with high-voltage *X*-rays are 1·627±0·010 and 2·183±0·012 Mv., respectively. The ratio of cross-sections (σ_{Be}/σ_D) at 15 kv. above the threshold voltage is ~10. The angular distribution of the neutrons from the photo-disintegration of D, investigated with *X*-rays of 2·43 Me.v. max. energy, is approx. isotropic. From these data the estimated ratio of the photo-magnetic to photo-electric cross-section is 6 : 1. N. M. B.

Penetrating cosmic-ray showers. L. Jánossy (*Proc. Roy. Soc.*, 1942, **A, 179**, 361—376).—The existence of showers penetrating at least 50 cm. of Pb is reported. These penetrating showers are parts of extensive air showers; they are neither energetic cascades nor knock-on showers, and are probably connected with the production of mesons. The connexion of the penetrating showers observed at sea-level with the production of mesons in the atm. is discussed under two alternative assumptions: that the mesons are produced (1) by photons, (2) by protons and possibly neutrons. G. D. P.

Electrical and anomalous scattering of mesotrons. R. P. Shutt (*Physical Rev.*, 1942, [ii], **61**, 6—13).—Photographs obtained without a magnetic field in a large counter-controlled cloud chamber containing Pb plates of two different thicknesses are analysed by Williams' scattering theory (cf. A., 1939, I, 291) with regard to the scattering of mesotrons in Pb. The scattering is > that expected from the theory. The average cross-section calc. for this anomalous large-angle scattering agrees with the results of Code (cf. A., 1941, I, 190), and accords with the assumption of a mesotron spin of ½ and a Hartree energy distribution. Spin 0 is possible, but spin 1 is definitely excluded. The observed anomaly may be explained by electromagnetic effects or by nuclear scattering of the proton component instead of mesotrons. N. M. B.

Absorption of extensive atmospheric showers of cosmic rays in air and lead. P. Auger and J. Daudin (*Physical Rev.*, 1942, [ii], **61**, 91—92).—Barometric coeff. and intensity measurements were made during 8 months by double coincidences of two horizontal counters at 3 m. separation. At sea-level a decrease of 1 cm. of Hg atm. pressure gives rise to 9±1% increase in the no. of showers; the resulting mass absorption coeff. is 0·0068±0·0007 sq. cm. per g. A comparison with counters at 3 m. and 13 m. separation gives the vals. 11±2% and 23±5%, respectively, for the coeffs.; the variation suggests a difference in origin of the narrow local air showers and the extensive showers. Measurements at 2900 m. altitude (cf. A., 1939, I, 593) are recalc. for comparison and give ~11% for the pressure coeff. and 0·008±0·0008 sq. cm. per g. for the mass absorp-

tion coeff. A discussion of results and those for absorption in Pb shows difficulties in reconciliation with the cascade theory. N. M. B.

Diurnal variation of extensive showers. P. Auger and J. Daudin (*Physical Rev.*, 1942, [ii], **61**, 95).—Curves of automatic counts by two unshielded coincidence counters show only a feeble max. (6%) at noon. This max. may be due to a thermal effect. N. M. B.

Aromatic problem: density distribution and zero-point energy of conductivity electrons in graphite. O. Schmidt (*Physikal. Z.*, 1941, **42**, 36—45).—The occurrence of a "metallic" type of linking in graphite and aromatic compounds is discussed with reference to the *B*-electron distribution. In graphite the axial quantum no. (n) in the ground state is 1, and the *B*-electrons are conc. in the C atom layers. Their mean density is $17{\cdot}63 \times 10^{22}$ per c.c., a val. > any known val. for a metal. The mean zero-point energy is 6·83 e.v. (157 kg.-cal.), which approx. equals the max. val. for Cu; since the binding energy is only ~1 e.v. the *B*-electrons are free. In the excited state $n = 2$. Reaction of graphite with electron-acceptors occurs by removal of electrons in a direction perpendicular to the C atom layers; chemical attack consequently proceeds initially in this direction. The constitution and electrical conductivity of certain "graphite salts" (cf. Rüdorff *et al.*, A., 1938, I, 410; *Z. anorg. Chem.*, 1940, **245**, 121) are discussed. A. J. E. W.

Is the Dirac theory of the positron Lorentzinvariant? H. Hönl (*Physikal. Z.*, 1941, **42**, 19—23).—Theoretical. A. J. E. W.

Separation of nuclear isomerides. E. P. Cooper (*Physical Rev.*, 1942, [ii], **61**, 1—5).—Chemical separation cannot be explained on the recoils involved, but, with *K* capture or with internal conversion accompanying the isomeric transition, the positive charge built up by the Auger effect during the electronic readjustment is enough to cause mol. dissociation. The calc. probabilities for Auger effect and for *X*-rays for all shells of the Br atom show an excess charge as high as $4{\cdot}7e$. The effect on homopolar binding is examined by using a H_2 mol. model. Results show that excess charges $\ll 4{\cdot}7e$ should cause dissociation in Br. N. M. B.

Interaction between a molecule and a metal surface. E. J. R. Prosen and R. G. Sachs (*Physical Rev.*, 1942, [ii], **61**, 65—73; cf. Bardeen, A., 1941, I, 30).—Mathematical. A treatment by the perturbation theory shows that the interaction energy $\propto 1/R$, where R is the distance between metal and mol., if the electron degeneracy in the metal is not taken into account, and $\propto R^{-2} \log R$ if it is taken into account. Considerations are here limited to $R \simeq$ the Bohr radius since electron–electron interaction is not taken into account. N. M. B.

Detection of the neutrino. K. C. Wang (*Physical Rev.*, 1942, [ii], **61**, 97).—When a β^+-radioactive atom captures a *K* electron instead of emitting a positron, the recoil energy and momentum of the resulting atom will depend solely on the emitted neutrino. It is suggested that the mass and energy of the neutrino could be found by measuring the recoil energy and momentum of the resulting atom alone. This is illustrated by the decay processes of ^{7}Be (43 days). Alternatively, for certain *K*-capture atoms, especially those having isomeric properties so that the *K*-capture is followed by an α-decay, if the radioactive substance is prepared to form some non-polar compound, the recoil energy of the resulting atom would break the bond and thus be detected chemically. N. M. B.

Nature of temperature. W. E. Benham (*Proc. Physical Soc.*, 1942, **54**, 121—128).—Mathematical. Some difficulty exists in reconciling temp. as energy per unit mass with the radiation theory conception of temp. Evidence is given to support the view that the ultimate significance of temp. is that it is measured by the thinness of a pulse of electromagnetic radiation. A new (unpublished) theory of radiation, which requires that central orbits shall be non-radiating when circular, is used to support a dimensional treatment in which the energy density of radiation is a function of the mass, rather than of the charge, of an electron and of the abs. temp. The dimensions of temp. appear to be $1/L$, and this is reconciled with energy per unit mass by attributing dimensions to "Newton's const." N. This and the gravitational const. have the dimensions $[N] = T^2/L^3$, $[G] = 1/M$. Dimensions of thermal quantities are listed and discussed. N. M. B.

II.—MOLECULAR STRUCTURE.

High-pressure carbon band system. R. K. Asundi and D. D. Pant (*Current Sci.*, 1941, **10**, 520—521).—It has been proposed by Fox *et al.* (A., 1937, I, 595) that the high-pressure C_2 bands are part of the Swan system. This view is untenable because it has been found that under certain discharge conditions the high-pressure bands only appear to the exclusion of all other C_2 bands, including the Swan bands. It is considered that it would be impossible to bring about the selective production of a single excited vibrational level. A. J. M.

Ultra-violet band spectrum of mercurous iodide. M. G. Sastry (*Current Sci.*, 1941, **10**, 521; cf. A., 1941, I, 362).—The class-I band system of HgI in the ultra-violet, reported by Wieland (A., 1929, 1127), is found to consist of two systems, designated a_1 and β_1, having a common final level, probably a $^2\Sigma$ state. A new system of HgI, designated *A*, and similar to the class-II system of HgCl, has been found in the region λ 2540. It arises from the transition $^2\Pi \rightarrow {}^2\Sigma$, and shows 4 component heads; the electronic separation in the $^2\Pi$ state is 126 cm.$^{-1}$ Vibrational consts. for the a_1, β_1, and *A* systems are tabulated. A. J. M.

Molecular spectra and fractionation of rare earths.—See A., 1942, I, 154.

Effect of intermolecular fields on the N–H vibration. G. Jung and E. Wygasch (*Z. physikal. Chem.*, 1941, **B**, **49**, 205—218).—NH_2Me has a series of absorption bands extending into the visible, which may be regarded as overtones of the fundamental at 3 μ. The third overtone at 0·8 μ. has been investigated for gaseous, liquid, and dissolved NH_2Me. Solutions of NH_2Me in H_2O, MeOH, EtOH, PrOH, dioxan, and C_6H_6 were used. There is a displacement of the absorption bands dependent on $[NH_2Me]$, and the effect of the solvents is in the same order for NH_2Me as for NH_3. There is a characteristic increase in the frequency displacement towards higher λ with increasing concn. for each solvent. The effect is the same for both NH_2Me and NH_3 in aq. and alcoholic solutions. The displacements for dioxan and C_6H_6 solutions are ≫ for solutions in H_2O or alcohols. An analysis of the displacements into one fraction depending on the interaction between solvent and solute, and another depending on interaction between the dissolved particles, shows that the effect of solvents on the NH vibration increases in the order H_2O, alcohols, C_6H_6, dioxan. A. J. M.

Complete analysis of absorption spectra. IV. Physico-chemical properties of the chromophoric groups, azomethine (·CH:N·) and azomethinevinylene (·CH:CH·CH:N·). E. Hertel and (Frl.) M. Schinzel (*Z. physikal. Chem.*, 1941, **B**, **48**, 289—308).—The acceptor variability of doubly-bound N atoms of ·CH:N· is < that of singly-bound N of amines. The transference of induced effects of substituents on N in ·CH:N· through a system of conjugated double bonds is extremely small. Compared with Ph, ·CH:CH· is the stronger variator. The effects of other substituent groups and the influence of location of the groups are discussed. W. R. A.

Absorption spectra of terpenoid compounds. II. Irone. A. E. Gillam and T. F. West (*J.C.S.*, 1942, 95—98).—The absorption spectrum of irone from two different sources in EtOH solution has been investigated. The results show that the active chromophoric group is C:C·C:O and not C:C·C:C·C:O. Using Woodward's generalisation, it is inferred that only one of the 3 H capable of being attached to the C:C linkage is replaced by other groups, so that the chromophore is either CHR:CH·CR:O or CH_2:CR·CR:O. It is concluded that irone is a β-substituted αβ-unsaturated ketone. Although the absorption spectra of irone from two different sources agree in giving a short-λ band at 2280 A., they differ sufficiently to show that the natural ketone is a mixture. This is confirmed by examination of the crude thiosemicarbazones derived from the two samples. A. J. M.

Absorption spectra of mono-, di-, and tri-chloroamines and some aliphatic derivatives. W. S. Metcalf (*J.C.S.*, 1942, 148—150).—The absorption spectra of NH_2Cl, some mono- and di-substituted chloroamines, $NHCl_2$, monosubstituted dichloroamines, and of NCl_3 have been investigated. Me, Et, and Pr$^\alpha$ derivatives have the same absorption spectra. The chloroamines examined have a characteristic absorption band lying between the limits $\nu_{max.} = 40{,}800$ cm.$^{-1}$, $\epsilon_{max.} = 416$, and $\nu_{max.} = 29{,}400$ cm.$^{-1}$, $\epsilon_{max.} = 255$. The less is the polarisability of the groups attached to the :N·Cl chromophore, the greater is the ν of max. absorption. A. J. M.

Relation between absorption spectra and chemical constitution of dyes.—See A., 1942, II, 89.

Structure and absorption spectra. III. Normal conjugated dienes. IV. αβ-Unsaturated ketones.—See A., 1942, II, 161, 164.

Colour and constitution.—See A., 1942, II, 153.

Photochemically derived binding energy of gaseous mercuric chloride. K. Wieland (*Helv. Chim. Acta.*, 1941, **24**, 1285—1298).—A photochemical val. for the energy of dissociation of a triat. mol. can be obtained if the resulting excited diat. radical emits a fluorescence spectrum. In this way a val. for the energy of the Cl–HgCl linkage in agreement with thermochemical vals. is obtained. F. J. G.

Extinction of fluorescence by ascorbic acid. K. Weber (*Radiologica*, 1938, **2**, 57—64, 237; *Chem. Zentr.*, 1938, ii, 3911).—Fluorescence of quinine sulphate, fluorenone, or pinakryptol-yellow is extinguished by ascorbic acid (I) (0·001—0·05M.), probably owing to the reversible oxidisability of (I). Addition of (I) to solutions of uranine, eosin, or æsculin reduces the intensity of fluorescence and liberates the free acid from the dye. (I) has no effect on the fluorescence of chlorophyll or ætioporphyrin. A. J. E. W.

Phosphorescence and its applications. J. N. Bowtell and E. E. Miles (*G.E.C. J.*, 1941, **11**, 256—265).—A short historical summary introduces a general account of phosphorescent and fluorescent

substances, effect of λ on excitation efficiency, effect of infra-red radiation on phosphorescence, and the theoretical explanation of luminescence. A survey is given of practical applications, brightness decay curves, sources of long-λ ultra-violet radiation for excitation, stability of materials, phosphorescent paints, solid synthetic resins and vitreous enamel, and painting processes. N. M. B.

Hydrogen bond formation. I. Amides. A. L. S. Rao (*J. Indian Chem. Soc.*, 1941, **18**, 337—349).—The effects of varying temp. and concn. on the Raman spectra of aq. $HCO{\cdot}NH_2$, NH_2Ac, and $CO(NH_2)_2$ have been studied. It is concluded that high polymerides are present which dissociate at higher temp. or on dilution. F. J. G.

Raman effect. CXXIV. ***cyclo*Hexane and oxalyl chloride.** K. W. F. Kohlrausch and H. Wittek. **CXXV. Chlorotrifluoromethane.** L. Kahovec and J. Wagner (*Z. physikal. Chem.*, 1941, **B, 48**, 177—187, 188—192).—CXXIV. Raman frequencies and polarisation data for *cyclo*hexane and $(COCl)_2$ are recorded. The observations support the "chair"-shaped structure rather than the planar structure for *cyclo*hexane.

CXXV. Raman frequencies for liquid $CClF_3$ are recorded and are discussed in relation to the frequencies and polarisation data for CF_4, CCl_2F_2, CCl_3F, and CCl_4. J. W. S.

Raman effect. CXXVI. Carbonyl sulphide and cyanogen chloride. CXXVII. Compounds containing nitrogen. XIX. Quinuclidine. J. Wagner (*Z. physikal. Chem.*, 1941, **B, 48**, 309—315, 316—320).—CXXVI. The polarisations of the Raman lines of COS and CNCl have been measured. COS is non-linear; CNCl is linear. Further evidence for these structures is adduced from the isotope splitting of lines.

CXXVII. Raman spectra of quinuclidine (**I**) and 1-aza-(1 : 2 : 2)-di*cyclo*heptane are recorded. Frequency formulæ for the valency force model of (2 : 2 : 2)-di*cyclo*octane have been derived. A satisfactory frequency description of (**I**) could not be obtained. W. R. A.

Electrical conductivity of titanium dioxide. M. D. Earle (*Physical Rev.*, 1942, [ii], **61**, 56—62).—Experiments show that TiO_2 is an electronic semi-conductor in which the current carriers are free electrons, in contrast to the hole conduction of the other type of semi-conductors. The variation of conductivity with O_2 pressure accords with the decomp. $TiO_2 \rightarrow Ti^+ + O_2 + e^-$. The variation with temp. is represented by $\sigma = Ae^{-\varepsilon/kT}$, where ε, the activation energy for producing free electrons, is ~1·7 e.v. Approx. measurements of the Hall effect show that the mean free path for the conduction electrons is very small. N. M. B.

Dielectric constant of carbon tetrachloride from 15° to 40°.—See **A., 1942, I, 158.**

Dipole moments of gallium chloride and its molecular compounds. H. Ulich and G. Heyne (*Z. physikal. Chem.*, 1941, **B, 49**, 284—292).—The prep. of $GaCl_3$ from Ga and HCl is described. When $GaCl_3$ is dissolved, with warming, in org. solvents, the solution is brown or yellow if ordinary solvents are used, but if specially purified and dried liquids are employed, the solutions are clear and colourless. The following additive *compounds* have been prepared: $GaCl_3$,PhCN (**I**), m.p. 125°, $GaCl_3$,*p*-$C_6H_4Me{\cdot}NO_2$ (**II**), m.p. 95°, $GaCl_3$,BzCl (**III**), m.p. 46°. The following dipole moments have been determined: $GaCl_3$ in C_6H_6, CS_2, and CCl_4; (**I**) in C_6H_6, (**II**) in C_6H_6, (**III**) in CCl_4. The moments of the additive compounds are of the same order as those of similar compounds with $AlCl_3$, $AlBr_3$, BCl_3, $BeCl_2$, $BeBr_2$, $TiCl_4$, and $SnCl_4$. A. J. M.

Field of electrets in the presence of gaseous ions. A. Gemant (*Physical Rev.*, 1942, [ii], **61**, 79—83; cf. Good, A., 1940, I, 41).—Calculations show that, contrary to available experimental evidence, the field of electrets ought to be completely shielded by the ions in the atm. Experimental facts on the electret field and the use of electrets in discharge tubes are discussed (cf. Sheppard, A., 1941, I, 449). N. M. B.

Refractive indices of PF_5 and OsO_4 and the dielectric constants of OsO_4, SF_5, SeF_6, and TeF_6. R. Linke (*Z. physikal. Chem.*, 1941, **B, 48**, 193—196).—n for PF_5 and OsO_4 vapours has been determined by the interferometer method at pressures 27—314 mm. and 2·5—11·9 mm., respectively. ϵ has been determined for SF_6, SeF_6, and TeF_6 at ~293° K. and for OsO_4 at 429·2° and 561·2° K. The results indicate that OsO_4 has zero dipole moment. From these and previous data the total and electronic (P_E) polarisations of OsO_4, PF_5, SF_6, SeF_6, TeF_6, BF_3, $HgCl_2$, $HgBr_2$, and HgI_2 are calc. and the at. polarisations (P_A) are derived. The vals. for P_A range between 16 and 67% of P_E, being the higher the more polar are the linkings in the compound concerned. J. W. S.

Molecular refraction nomograph. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 258).—A nomograph has been constructed for solving the Lorentz–Lorenz equation $R = M(n^2 - 1)/d(n^2 + 2)$, where R = mol. refraction, M = mol. wt., n = refractive index, and d = density. C. R. H.

Structural algebra in chemistry. A. A. Balandin (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 447—479).—The relations between the elements of a geometrical structure are represented symbolically by structural matrices, and the algebra of such matrices is developed. Applied to chemistry, this structural algebra affords a concise and quant. representation of structures, equilibria, etc., and in some cases facilitates calculations. F. J. G.

Mechanisms of covalent-bond fission. W. A. Waters (*J.C.S.*, 1942, 153—157).—In the case of an unsymmetrical covalent bond, there is a close connexion between the electrostatic dipole energy and resonance energy. The Coulombic energy of a bond is usually the greater part of the ionic resonance energy, and thus often gives a better criterion of the extent of internal resonance in a polar bond than does the dipole moment alone. The energy requirements for unimol. dissociations are considered, and the electrostatic factors determining the activation energies of both ionic and neutral reactions are compared. The favoured mechanism for a unimol. dissociation is largely determined by the dielectric const. of the solvent. Available experimental data confirm these conclusions. The activation energies of bimol. reactions are also considered. A. J. M.

Application of the *p*-hydrogen method to some problems of organic constitutions. I. G. M. Schwab and E. Schwab-Agallidis (*Z. physikal. Chem.*, 1941, **B, 49**, 196—204; cf. A., 1938, I, 625).—The effect of org. substances on *p*-H_2 can be used as a test for their radical nature, and the method is applicable where the determination of magnetic susceptibility cannot be used. The method was applied to protoporphyrin (**I**) and monobromobenzanthrone (**II**). (**I**) has no action on *p*-H_2 and does not therefore exist as di-radicals. Similarly (**II**) is found not to be a mono-radical. These results agree with those obtained by the magnetic method. A. J. M.

Rotating bubble method for the determination of surface and interfacial tensions.—See A., 1942, I, 159.

III.—CRYSTAL STRUCTURE.

Diffuse spots in *X*-ray photographs. (Sir) W. H. Bragg (*Nature*, 1941, **148**, 780; cf. A., 1942, I, 135).—Simple diffraction formulæ, which are independent of elastic consts., predict accurately the positions of all the diffuse spots, but the theory that ascribes the spots to the interaction of the structural periodicities of the crystal and the periodicities of the elastic waves does not do so. L. S. T.

Thermal scattering of *X*-rays in crystals. J. Weigle and C. S. Smith (*Physical Rev.*, 1942, [ii], **61**, 23—34).—Mathematical. The reciprocal lattice of a crystal with heat waves is calc. under simplifying assumptions, and a simple representation of the principal facts concerning observed diffuse scattering max. is obtained. The assumptions are justified and the problem of scattering from waves of large amplitude is considered. N. M. B.

Scattering of polarised *X*-rays by ferromagnetic substances. E. Rodgers (*Physical Rev.*, 1942, [ii], **61**, 35—38; cf. A., 1937, I, 55).—If high-frequency polarised *X*-rays are scattered by some substance, the total intensity of the scattered rays should be altered by anything leading to special orientations of the spins of the scattering electrons. Experimental attempts to detect the effect on intensity due to changes in spin orientations in ferromagnetics when magnetised were unsuccessful. An attempt to reconcile these and the results of gyromagnetic experiments leads to orientations of the spin, giving the spin magnetic quantum nos. $\frac{1}{2}$ and $-\frac{1}{2}$. N. M. B.

Evaluation of *X*-ray back-reflexion pictures.—See A., 1942, I, 156.

Structure of tricalcium aluminate. H. F. McMurdie (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 499—505).—*X*-Ray diffraction measurements by the powder method indicate that $Ca_3Al_2O_6$ has a cubic unit cell with a_0 15·24 A. and containing 24 mols. Comparison with data for $CaTiO_3$ and Na_2CaSiO_4 indicates that the metal atoms are arranged in a body-centred cubic lattice with a_0 3·81 A. This is confirmed by measurements on $Sr_3Al_2O_6$, which has a cubic unit cell with a_0 15·82 A. No conclusions can be drawn concerning the arrangement of the O atoms. Since many compounds have a lattice with a_0 3·81 A., and structures with some irregularity will not show a strong-line pattern, it is suggested that the patterns obtained with slowly quenched glass from Portland cement (Brownmiller, B., 1938, 654) were caused by submicroscopic growths of a metastable cryst. compound. J. W. S.

Diffraction of fast electrons in thin films of hydrated cellulose. V. A. Kargin and D. I. Leipunskaja (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 397—410).—The scattering of fast electrons by thin films of hydrated cellulose gives an intensity curve agreeing with that calc. for the cellobiose mol., and showing no sign of an ordered structure. F. J. G.

Variation with temperature of the principal elastic moduli of rock-salt near the m.p. L. Hunter and S. Siegel (*Physical Rev.*, 1942, [ii], **61**, 84—90; cf. Durand, A., 1936, 1329).—Measurements are reported over the range 20—804°, the m.p., by means of a tripartite piezoelectric oscillator consisting of a quartz crystal driver, an intermediate fused SiO_2 bar, and the NaCl specimen. The shear consts. C_{44} and $C_{11} - C_{12}$ decrease nearly linearly with temp., reaching non-zero vals. at the m.p. The compressibility increases

with temp., but drops suddenly close to the m.p. Results are compared with predictions based on Born's theory of the stability of crystal lattices. N. M. B.

"Flow" in stressed solids; an interpretation. R. W. Goranson (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1023—1033).—The mechanism involved in "creep," "plastic flow," and "pseudo-viscous" flow is interpreted (cf. A., 1942, I, 188). Plastic flow in solids is regarded as taking place by means of a change-of-phase transfer mechanism as solid → fluid → solid or solid → solution → recrystallisation of solid. Expressions are derived from consideration of the thermodynamic potential relations for different physical conditions. L. S. T.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Mol. wt. of sulphur vapour. W. Klemm and H. Kilian (*Z. physikal. Chem.*, 1941, **B**, **49**, 279—283).—New determinations of the v.d. of S between 450° and 850° give vals. for the mol. wt. somewhat > those obtained by Preuner *et al.* (A., 1910, ii, 118). A. J. M.

External electrical potential of metals in a temperature gradient. H. Lämmermann and E. Lange (*Z. physikal. Chem.*, 1941, **B**, **49**, 219—234).—For a metal in a temp. gradient in moist air, the temp. coeff. of the potential $d\psi/dT$ has a definite val., whereas in vac. and for dry gases, $d\psi/dT$ is almost zero. This difference is due to adsorbed H_2O. Approx. the same vals. for $d\psi/dT$ are obtained if N_2 is substituted for air. A. J. M.

Names of electrical units. E. A. Guggenheim (*Nature*, 1941, **148**, 751).—The charge that repels a similar charge at a distance of 1 cm. with a force of 1 dyne is called a franklin. Units of the most important electrostatic quantities in cm.-g.-sec.-franklin and in m.-kg.-sec.-coulomb units are tabulated. L. S. T.

Velocity of sound in methyl methacrylate polymeride. L. R. Weber and F. P. Goeder (*Physical Rev.*, 1942, [ii], **62**, 94—95).—A preliminary report of measurements by compressional forces on rods of various sizes and by a modification of the electrostatic method shows widely divergent results. Explanations are suggested. N. M. B.

Refractive indexes of gases at high radio frequencies. F. J. Kerr (*Nature*, 1941, **148**, 751—752).—At 58 Mc. per sec., 100°, and 1 atm., the vals. obtained are $1{\cdot}00024(0) \pm 0{\cdot}000006$ and $1{\cdot}0030(1) \pm 0{\cdot}00007$ for dry air and H_2O vapour, respectively. L. S. T.

***P*–*V*–*T* relations and derived quantities for hexanes.** E. A. Kelso and W. A. Felsing (*Ind. Eng. Chem.*, 1942, **34**, 161—163).—Mol. vols. of liquid Pr^{β}_2 over the temp. and pressure ranges 100—225° and 5·6—311·8 atm. are tabulated. Data for the sp. vol. under its own v.p. and *P*–*V*–*T* data in the gaseous state are also tabulated. The data, together with similar data for *n*-C_6H_{14} and $Pr^{\alpha}Pr^{\beta}$, have been utilised to evaluate vals. of pv/RT and fugacity–pressure ratios. C. R. H.

Pressure–temperature chart for vapours. M. Hirsch (*Ind. Eng. Chem.*, 1942, **34**, 174—182).—Mathematical. A new method of plotting logarithmic pressures using convergent isotherms results in straight lines parallel or inclined to the pressure axis according to whether the ordinary plots of log p against $1/T$ are linear or curved. The application of the method to the solution of problems connected with Trouton's rule and the Clapeyron and van der Waals expressions is illustrated. C. R. H.

Cellulose and its derivatives as liquids of fixed structure. K. Ueberreiter (*Z. physikal. Chem.*, 1941, **B**, 48, 197—218).—The *V*–*T* relationships of cellulose and its derivatives over the solidification range indicate that they can be regarded as a "liquid of fixed structure," *i.e.*, a solid with structure similar to that of a liquid (cf., A., 1942, I, 84). Hydrocellulose forms relatively rigid macro-mols., but nitration and acetylation increase the mobility of the links in the macro-mol. chains, leading to "internal softening." "External softening" has been studied by measurement of the *V*–*T* relations for ethylcellulose or cellulose nitrate to which $(C_6H_4Me)_3PO_4$ (**I**) has been added. The solidification point is depressed considerably by small additions of (**I**), but further additions produce decreasing effects. Swelling of cellulose in H_2O is a special case of external softening. The *V*–*T* curves of artificially produced cellulose fibres show anomalous inflexions on initial heating, attributable to strains in the macro-mols. Polystyrenes show similar phenomena. J. W. S.

Thermal expansion of pure metals. II. Molybdenum, palladium, silver, tantalum, tungsten, platinum, and lead. F. C. Nix and D. MacNair (*Physical Rev.*, 1942, [ii], **61**, 74—78; cf. A., 1942, I, 50).—High-precision measurements made interferometrically from room temp. to liquid-N_2 temp. are reported, and comparisons with the Grueneisen theory are made. N. M. B.

Critical state. VI. Vapour pressure curve of naphthalene up to the critical point. E. Schröer (*Z. physikal. Chem.*, 1941, **B**, **49**, 271—278).—Apparatus for the determination of crit. data is described. The crit. data of $C_{10}H_8$ have been determined. The crit. temp. is 478·5—480°; crit. pressure 42 kg. per sq. cm.; crit. d 0·314 g. per c.c. The v.p. curve is given between 200° and 500°. A. J. M.

Explorations toward the limit of utilisable pressures.—See A., 1942, I, 159.

[Viscosity of air by rotating-cylinder method.] G. Kellström (*Phil. Mag.*, 1941, [vii], **31**, 466—470; cf. A., 1937, I, 231).—Corrections for the influence of the air on the effective moment of inertia of the inner cylinder and the end-correction to the length of the inner cylinder are applied to the author's earlier data, giving $1{\cdot}8204 \pm 0{\cdot}003 \times 10^{-4}$ at 20° and $1{\cdot}8352 \pm 0{\cdot}0030 \times 10^{-4}$ at 23° as final vals. for η. L. J. J.

Method of successive approximations for the solution of the boundary layer equations. J. H. Preston (*Phil. Mag.*, 1941, [vii], **31**, 452—465).—The author's iteration method (*ibid.*, 1938, [vii], **26**, 791) for flow at high Reynolds nos. gives results of limited accuracy when experimental pressures are used. The position of the breakaway may be uncertain even when a large no. of approximations are used. L. J. J.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Self-diffusion of hydrogen chloride and hydrogen bromide. H. Braune and F. Zehle (*Z. physikal. Chem.*, 1941, **B**, **49**, 247—256).—The diffusion of DCl with respect to HCl, and of DBr with respect to HBr, has been investigated. The difference in the diffusion coeff. $D_{DCl} - D_{HCl}$ is 0·1246 at 295° K., and $D_{DBr} - D_{HBr}$ is 0·0792 at 295·3° K. The results are discussed. A. J. M.

Condensation of vapours in a carrier gas. F. Frey (*Z. physikal. Chem.*, 1941, **B**, **49**, 83—101).—An apparatus is described with which it is possible to determine fog formation as a result of adiabatic expansion to high supersaturation. The relationship between the no. of drops per unit vol. and the degree of supersaturation has been estimated. In the absence of ions the crit. supersaturation is higher and the increase in the no. of drops occurs more slowly than when ions are present; reasons for this are advanced. The necessary conditions for the adiabatic process have been established and the influence of liberated heat on the condensation is discussed. W. R. A.

Viscosity of binary liquid mixtures and associated liquids. R. Linke (*Z. physikal. Chem.*, 1941, **A**, **188**, 191—197).—η has been determined for the systems $COMe_2$–$CHCl_3$ and C_6H_6–CCl_4 at 10—50° and for $PhNO_2$ at 10—180°. The results are discussed as illustrating the influence of compound formation and association. F. J. G.

Specific viscosity of suspensions and solutions. E. W. J. Mardles (*Trans. Faraday Soc.*, 1942, **38**, 47—54).—A detailed account of experiments leading to the conclusions previously announced (A., 1942, I, 16) is given. F. L. U.

Viscosities of aqueous solutions of some phenanthrenesulphonic acids. T. R. Bolam and J. Hope (*J.C.S.*, 1941, 850—854).—η for aq. solutions of *p*-$C_6H_4Me{\cdot}SO_3H$, phenanthrene-3-sulphonic acid, 9-chloro- and 9-bromo-phenanthrene-3-sulphonic acid are recorded. The η-concn. curves for the phenanthrene acids show abnormalities corresponding with those for Λ, and indicating micelle formation. F. J. G.

Relaxation times in mixtures of polar and non-polar liquids. H. Spengler (*Physikal. Z.*, 1941, **42**, 134—143).—The relaxation time of $PhNO_2$ in C_6H_6 and of PhCl in C_6H_6 has been determined as a function of concn. by the method of high-frequency heating. It is to be expected that, in consequence of the greater moment of $PhNO_2$ compared with that of PhCl, there will be a stronger coupling in the case of $PhNO_2$, and a more rapid decrease of relaxation time with concn. This is demonstrated by experiment. A. J. M.

Influence of differences in the molecular volumes of liquids on the vapour pressure curves of their binary mixtures. K. Fredenhagen (*Z. physikal. Chem.*, 1941, **B**, **48**, 219—227).—The conclusions of Frahm (A., 1940, I, 19) are criticised. Thermodynamic and kinetic considerations indicate that the v.p. of a binary mixture depends on the mol. vols. of the components. In most cases vol. or energy changes during mixing also modify the v.p. With components which have equal intermol. forces and do not react, the free energies of the components with lower and higher mol. vol. are increased and decreased, respectively, and consequently the partial v.p.–composition curves of these components are lowered and raised, respectively, relative to the straight-line relations of Raoult's law. J. W. S.

Constitution of sodium silicate solutions. R. C. Ray, P. B. Ganguly, and A. B. Lal (*Trans. Faraday Soc.*, 1942, **38**, 104—108).—The diffusion of Na silicates with initial compositions varying from $Na_2O/SiO_2 = 0{\cdot}5$ to 0·25 has been examined by analysing successive layers. In all cases the ratio Na_2O/SiO_2 increases with distance and tends to the val. 2·0. Measurements of p_H as well as published data indicate that hydrolysis is inadequate to account for the

observed changes, and the conclusion reached is that the solutions studied contain a single species of salt, viz., Na_4SiO_4 or $Na_2H_2SiO_4$, and that the remaining SiO_2 is present as colloidal SiO_2,H_2O.
F. L. U.

Order in the alloy Cu_3Au. L. H. Germer, F. E. Haworth, and J. J. Lander (*Physical Rev.*, 1942, [ii], **61**, 93).—Electron diffraction patterns for thin films indicate that order is produced by heating for 16 hr. at 170°, but diffuseness indicates the presence of anti-phase domains (cf. Nix, A., 1942, I, 17). Stronger and sharper superstructure rings are obtained from films which have been heated at higher temp. An ordered specimen on heating shows no marked change of pattern up to ~300°; above this temp. the superstructure rings become broader and less prominent, reaching a steady state at ~370°. At 370—550° the diffraction pattern shows unresolved superstructure rings, confirming the existence of short-range order above the Curie point (380° or 390°). N. M. B.

Variation of the magnetic properties of antimony with electron concentration. S. H. Browne and C. T. Lane (*Physical Rev.*, 1941, [ii], **60**, 895—899).—The susceptibilities perpendicular $\kappa_\perp$ and parallel $\kappa_\parallel$ to the principal (trigonal) axis were determined for single crystals of pure Sb and solid-solution alloys of Sb with Sn, Ge, Pb, and Te. As the % of alloying metal increases $\kappa_\perp$ changes very little and remains diamagnetic, but $\kappa_\parallel$ decreases sharply, and, for Sn and Ge changes to paramagnetic beyond 1·17 at.-% Sn and 1·25 at.-% Ge. The calc. no. of electrons which overlap into the second Brillouin zone in Sb is 10^{-2} per atom. The bearing of results on the current theory of metals is discussed. (Cf. following abstract.)
N. M. B.

Temperature variation of the magnetic susceptibilities of antimony–tin alloys. S. H. Browne and C. T. Lane (*Physical Rev.*, 1941, [ii], **60**, 899—905; cf. preceding abstract).—Measurements on single crystals of pure Sb and of Sb–Sn alloys up to 4·1 at.-% Sn in the temp. range 77° K. to room temp. show that $\kappa_\perp$ (diamagnetic) is practically independent of temp. for all the alloys; $\kappa_\parallel$ (diamagnetic and paramagnetic) decreases with rise of temp. except for the alloy of 1·06 at.-% Sn, but this is brought into agreement by a correction of the temp.-independent diamagnetic susceptibility of the lattice ions. Experimental $\kappa_\parallel$ are compared with Stoner's expressions for the susceptibilities of free electrons, assuming that $\kappa_\parallel$ is due to the electrons overlapping into the second Brillouin zone. The degeneracy temp. of these electrons is found to be ~475° K., ~0·25 of what it would be for free electrons. Effective masses of the electrons, which occur as parameters in the energy equation, are calc. Theoretical consequences are discussed. N. M. B.

Equilibrium relations in the solid state of the iron–cobalt system. W. C. Ellis and E. S. Greiner (*Trans. Amer. Soc. Met.*, 1941, **29**, 415—434).—Redeterminations by thermal analysis of the temp. of the γ–α transformation and the Curie point of Fe–Co alloys with <70 at.-% Co confirmed previous studies. In alloys with 70—90 at.-% Co the phase boundaries were determined by *X*-ray diffraction methods, and an extended region of $\alpha + \gamma$ equilibrium was established. At 600°, the $\alpha + \gamma$ region exists from 76·5 to 88·5 at.-% Co. The lattice consts. of the α phase were measured at 25°; additions of Co increase the cell size from 2·8607 A. for Fe to 2·8611 A. for 20·5 at.-% Co alloy; further additions then decrease the size rapidly. In alloys with 40—67 at.-% Co the cell size is slightly larger after quenching from 575° then after quenching from 800°. This effect is associated with an order–disorder change, the crit. temp. of which was located by thermal analysis. The ordered cell has a CsCl structure. J. C. C.

Nature of a satellite in the *X*-ray pattern of α-crystals, and differentiation of a new phase, α', by the surface recrystallisation method in certain ternary alloys. I. Iron–nickel–aluminium system. S. Kiuti (*Aeronaut. Res. Inst. Tokyo Imp. Univ., Rept.* 207, 1941, **16**, 167—204; *Bull. Iron Steel Inst.*, 1941, No. 74, 158A).—In view of the importance of the discovery of a new α' phase in the magnetic Fe–Ni–Al system (*ibid., Rept.* 203, 1940, **15**, 601), experimental data obtained in the course of early studies of this phase are reported. In these studies the possibility of differentiation of the α' phase by the surface recrystallisation method was considered theoretically and verified experimentally by *X*-ray analysis. The conclusion from calculations was that the α' phase is a body-centred cubic lattice with a simple cubic superstructure of the CsCl type. R. B. C.

***X*-Ray study on mechanism of the splitting phenomenon of α crystals in interiors of some ternary alloys. I. Iron–nickel–aluminium system.** S. Kiuti (*Aeronaut. Res. Inst. Tokyo Imp. Univ., Rept.* 207, 1941, **16**, 271—298; *Bull Iron Steel Inst.*, 1942, No. 74, 158A).—The discovery of a new α' phase in the surface layers of magnetic Fe–Ni–Al alloys (cf. preceding abstract) raised the question whether the same phase occurs in the interior of the specimens. After subjecting specimens to prolonged annealing at const. temp., the splitting of the α crystals was found by *X*-ray examination to have taken place in the interior also; this confirmed the author's earlier conclusion obtained by the surface recrystallisation method.
R. B. C.

Solubility of calcium carbonate in tropical sea-water. C. L. Smith (*J. Marine Biol. Assoc.*, 1941, **25**, 235—242).—The solubility product of $CaCO_3$ in sea-H_2O of salinity 3·6% at 29·7° has been determined as ~$1{\cdot}16 \times 10^{-6}$. J. W. S.

Solubility of nickel ions in aqueous alkaline carbonate–tungstate solutions. M. L. Holt and D. A. Swalheim (*Trans. Electrochem. Soc.*, 1942, **81**, *Preprint* 2, 11—25).—Measurement of the solubility (*s*) of $NiSO_4$ in Na_2CO_3–tungstate solutions shows that *s* depends on time as well as on the composition of the solvent. *s* decreases with time and with decrease in $[Na_2CO_3]$, and *s* is also influenced by the amount and nature of the tungstate, increasing with increase in tungstate concn. and being greater for solutions prepared from Na_2WO_4 than for solutions of the same equiv. $[H_2WO_4]$ prepared from $5Na_2O,12WO_3$. Under conditions which favour $NaHCO_3$ formation and in solutions containing added $NaHCO_3$ there is an increase in *s*. This suggests that it is $NaHCO_3$ which favours $NiSO_4$ dissolution rather than the formation of sol. Ni tungstate complexes, a view which is supported by electrolysis experiments which are described. The presence of $NaHCO_3$ may affect *s* by forming sol. $Ni(HCO_3)_2$ or, what is more likely in view of the electrolysis data, $Na_2Ni(CO_3)_2$. C. R. H.

Nephelometric method for determination of solubilities of extremely low order. W. W. Davis and T. V. Parke, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 101—107).—A nephelometric method capable of measuring the solubilities of polycyclic hydrocarbons down to ~1 μg. per l. is described. Data for the solubilities in H_2O of 3 : 4-benzpyrene, 10-ethyl-1 : 2-benzanthracene, and phenanthrene are reported. Extensions and limitations of the method are discussed.
W. R. A.

Solubility of carcinogenic and related hydrocarbons in water. W. W. Davis, M. E. Krahl, and G. H. A. Clowes (*J. Amer. Chem. Soc.*, 1942, **64**, 108—110).—Using the nephelometric method (preceding abstract) the solubility of 31 polycyclic hydrocarbons in H_2O at 27° has been determined. W. R. A.

Solubility and chemical constitution. E. Leikola (*Suomen Kem.*, 1940, **13, B**, 13—17).—The solubility of H_2O in mixtures of non-ionising (C_6H_6, PhMe, *o*-, *m*-, and *p*-xylene, 1 : 3 : 5-$C_6H_3Me_3$, $PhNO_2$, NH_2Ph, $CHCl_3$, CCl_4, CS_2, and *o*-, *m*-, and *p*-$C_6H_{10}Me{\cdot}OH$) with semi-ionising (MeOH, EtOH, Pr$^\alpha$OH, Pr$^\beta$OH, $COMe_2$, AcOH, $EtCO_2H$, Pr$^\alpha CO_2H$, and C_5H_5N) liquids has been studied. In mixtures with MeOH, EtOH, AcOH, $EtCO_2H$, or C_5H_5N (but not Pr$^\alpha$OH, Pr$^\beta$OH, Pr$^\alpha CO_2H$, or $COMe_2$) H_2O is decreasingly sol. with increasing replacement of H by Me in C_6H_6 or by Cl in CH_4. In mixtures with MeOH H_2O is sol. in $C_6H_6 < PhNO_2 \ll NH_2Ph$, *o*- < *p*- < *m*-$C_6H_{10}Me{\cdot}OH$, but equally in all three xylenes. The solubility of H_2O in C_6H_6 (or $CHCl_3$) is with EtOH > MeOH > Pr$^\beta$OH > Pr$^\alpha$OH, in PhMe (or CCl_4) with EtOH, Pr$^\alpha$OH > MeOH, and in xylene with Pr$^\alpha$OH > EtOH, MeOH. Similar variation with size of the alkyl group is found with AcOH, $EtCO_2H$, and Pr$^\alpha CO_2H$ in the two lipoid series. In general, the size of the alkyl group of the semi-ionising solvent giving max. solubility of H_2O increases with increasing no. of Me or Cl groups in the lipoid solvent.
M. H. M. A.

Difference in heat of adsorption of ortho- and para-hydrogen. E. Cremer (*Z. physikal. Chem.*, 1941, **B**, **49**, 245—246).—The difference in the heat of adsorption of *o*- and *p*-H_2 on solid O_2 is <90 g.-cal. This can be explained as due to the hindrance of rotation imposed on the *o*-H_2 mol. by the action of neighbouring mols. of the adsorbing agent. A. J. M.

Van der Waals adsorption of gases (N_2, A, CO, CH_4, H_2O, D_2O, etc.) on glass plates. A. van Itterbeek and W. Vereycken (*Z. physikal. Chem.*, 1941, **B**, **48**, 131—147).—The adsorption isotherms for A, N_2, CO_2, CH_4, and O_2 at the temp. of liquid O_2, for CS_2 and $COMe_2$ between 294° and 213° K., and for H_2O and D_2O between 45° and 0°, on glass plates have been determined. In the case of H_2O and D_2O no further adsorption takes place above 180°. This is also true of H_2 and O_2 at high temp. In the range of pressures where the equilibrium pressure is of the same order as the saturation pressure the adsorption curves rise rapidly, but the slope decreases where a layer 2 mols. thick is formed. Where the equilibrium pressure is small compared with the saturation pressure, a unimol. layer only is formed, and the adsorption curve can be analysed by means of Langmuir's equation. The results for bimol. layers agree with the theory of Brunauer *et al.* (A., 1938, I, 190), except in the case of O_2, where they are in agreement with the theory of Zeise (A., 1928, 1182).
A. J. M.

Mixed adsorption of amylene and ethylene on activated charcoal. A. Magnus and A. Spalt (*Z. physikal. Chem.*, 1941, **B**, **49**, 187—195).—The adsorption of amylene (**I**) at 100° and of C_2H_4 at 0° and 100° on activated C has been investigated. The results do not agree well with the simple adsorption formulæ of Freundlich and Langmuir, but in the case of C_2H_4 at 100° the data fit the formula $1/A = 0{\cdot}0202 + (27{\cdot}55/p) - (1200/p^2)$ with fair accuracy (A = wt. adsorbed, p = pressure in mm.). The adsorption of a mixture of (**I**) and C_2H_4 was also studied. (**I**) blocks the most active spots without being affected by the C_2H_4. A. J. M.

Van der Waals sorption of chlorine by silica gel at low temperatures. L. H. Reyerson and C. Bemmels (*J. Physical Chem.*, 1942, **46**, 31—35).—The sorption of Cl_2 by SiO_2 gel at 30·2°, 0°, and

$-25{\cdot}3°$ over the pressure range 0—732 mm. Hg has been determined in order to extend the range of earlier data (cf. A., 1937, I, 611). The data conform to Brunauer's sorption theory. C. R. H.

Van der Waals sorption of gaseous hydrogen chloride, hydrogen bromide, and hydrogen iodide by silica gel. L. H. Reyerson and C. Bemmels (*J. Physical Chem.*, 1942, **46**, 35—42).—The sorptions of HCl, HBr, and HI by SiO_2 over a wide range of temp. and pressure have been determined. The sorptions of the three acids show regular behaviour and are very similar, and also appear similar to the sorption of Cl_2. The data are in general agreement with Brunauer's sorption theory. C. R. H.

Adsorptive properties of synthetic resins. V. S. S. Bhatnagar and M. Sarup (*J. Indian Chem. Soc.*, 1941, **18**, 447—452).—Acids are adsorbed by basic resins (A., 1937, I, 234) in the order HI > HCl > HBr; $HNO_3 > H_2SO_3 > H_3BO_3$; and $H_2CrO_4 > HClO_4 > H_2SO_4 > H_3PO_4$. Bases are adsorbed by both basic and acid resins in the order $Ba(OH)_2 > Sr(OH)_2 > Ca(OH)_2$ and KOH > NaOH > LiOH > NH_4OH. For basic resins halogens are adsorbed in the order I > Br > Cl, and in salts $Rb^{\cdot} > K^{\cdot} > Na^{\cdot} > Li^{\cdot}$ and $I' > Br' > Cl'$. It is concluded that at the resin–H_2O interface of a basic resin, the mol. of the sorbate will orient itself in such a way that the polar group is towards the resin, so that the greater is the polarisability of the sorbate in solution the greater will be the adsorption. The reverse holds for acid-condensed phenolic resins. F. R. G.

Application of the Gibbs adsorption equation to solutions of paraffin-chain salts. A. E. Alexander (*Nature*, 1941, **148**, 752).—A discussion. L. S. T.

Sorption of soluble dyes by gelatin. S. E. Sheppard, R. C. Houck, and C. Dittmar (*J. Physical Chem.*, 1942, **46**, 158—176).—The sorption of tartrazine, Alizarin Rubinol R, anthraquinone-blue, thiacarbocyanine, and methylene-blue by two types of gelatin, CaO-process with isoelectric point at p_H 4·77 and acid-process with isoelectric point at p_H 8·2, has been investigated. The dye is taken up according to a reversible action between protein cation and dye anion in the case of acid dyes, and between protein anion and dye cation in the case of basic dyes. Dye distribution is governed by p_H, neutral salt content, and dye concn. Buffered solutions dye more strongly than the unbuffered, particularly below the isoelectric point. C. R. H.

Calculation of the surface area of microporous solids from measurements of heat conductivity. S. S. Kistler (*J. Physical Chem.*, 1942, **46**, 19—31).—A derived equation connecting the mean free path, l, in a microporous solid with the internal surface area, A, permits the calculation of A from thermal conductivity data. The calc. vals. of l for samples of SiO_2 aerogel are $\sim 6 \times 10^{-6}$ cm. which yield $\sim 4 \times 10^6$ sq. cm. per g. for A, a val. verified by adsorption data. The thermal conductivity of SiO_2 aerogel diminishes slightly as the density increases from 0·025 to ~0·2, but further increase in d is accompanied by a rapid increase in thermal conductivity. C. R. H.

Structure of surfaces of solutions. A. E. Alexander (*Trans. Faraday Soc.*, 1942, **38**, 54—63).—Contrary to the interpretation by McBain and co-workers of surface tension and surface pressure data (cf. A., 1941, I, 333; 1940, I, 356, and earlier abstracts), which assumes the formation of a surface pellicle or of a complex adsorption layer, a study of force-area curves for $Ph{\cdot}[CH_2]_2{\cdot}CO_2H$ and $C_{12}H_{25}{\cdot}SO_3H$ solutions indicates that all the experimental data are consistent with the formation of no more than a unimol. layer, when due account is taken of the slowness of the rate of dissolution of surface layers when compressed. Failure of the Gibbs theorem is apparent only when the solutions studied are so conc. that they contain aggregated mols. or micelles. F. L. U.

Diffusion of gases through high-polymeric substances. I. Simple apparatus for measurement of diffusion of gases through films. F. H. Müller (*Physikal. Z.*, 1941, **42**, 48—53).—In one type of apparatus gas passing through the film under test is condensed in a small reservoir and measured manometrically. In a second type for non-condensible gases the measurement is made in an adapted McLeod gauge in which gas diffuses directly into the larger reservoir. The apparatus gives results accurate to 5—10%; the time taken by a measurement (excluding time required to reach the stationary state) is from 1 min. [permeable films, *e.g.*, cellulose acetate (I)] to >1 hr. (rubber 1 mm. thick). Typical diffusion const. data are given for H_2O in polystyrene, polyvinyl chloride, benzylcellulose, and (I), and for H_2, He, H_2O, Ne, O_2, A, Kr, and Xe in (I). A. J. E. W.

Structure and electrical behaviour of collodion membrane. III. Base-exchange properties of collodion. K. Sollner, C. W. Carr, and I. Abrams (*J. Gen. Physiol.*, 1942, **25**, 411—429; cf. A., 1941, I, 466; Beutner, *et al.*, A., 1933, 900).—Although theoretical considerations indicate that the electrochemical properties of collodion are determined by its content of dissociable acidic groups and that the base-exchange capacity of collodion preps. is a measure of that content, chemical and electrometric titration of preps. of varied origin, pretreated in various ways and having widely varying electrochemical properties, shows no regular correlation between electrochemical activity and base-exchange capacity. Although large capacity is apparently always associated with moderate or great activity, very low capacity is associated sometimes with high, sometimes with low, activity. The significance of these findings for the problem of the structure of collodion membranes is discussed. W. McC.

Thirty years of colloid chemistry. W. D. Bancroft (*J. Physical Chem.*, 1942, **46**, 1—9).—A lecture. C. R. H.

Foam time. I. Method of measuring foam time. Experiments with saponin and methylcellulose. II. Experiments with aliphatic alcohols. Relation between chain length and foam time. Critical foam time and conjugate foaming solutions. F. Schütz (*Trans. Faraday Soc.*, 1942, **38**, 85—93, 94—104).—I. Foam time (t_f) is defined as the duration of foam produced under standard conditions, and is a more satisfactory criterion of stability than vol., height, or size of bubbles. t_f is influenced by the temp. and humidity of the external air, by the time of passage of gas bubbles through the liquid, and in many cases by the age of the solution. An arrangement is described in which these factors can be controlled. Measurements with saponin (I) solutions show that $t_f = ac^b$ (c = concn.); two samples of (I) showing only very small differences in surface tension gave relatively large differences in t_f. A similar relation was found with fractions of H_2O-sol. methylcellulose of different mol. wts.; with these the log t_f–log c graphs are approx. parallel and t_f increases with the mol. wt.

II. t_f–c curves for aq. solutions of the first five saturated aliphatic n-alcohols exhibit a max. at concns. (c') that diminish with the mol. wt. according to $c' = ab^n$, where n is the no. of C atoms in the alcohol and a and b are consts. With BuOH the n- and *sec.*-alcohols show a definite max.; $Bu^{\beta}OH$ and $Bu^{\gamma}OH$ do not. Solutions on either side of the max. having equal t_f vals. are termed conjugate foaming solutions; their foams behave differently towards staining reagents and are therefore not identical, although they have the same stability. t_f–c curves for mixtures still exhibit the max. characteristic of one or more of the components. F. L. U.

Electrochemical character of colloids. Relation between the activity and conductivity coefficients. W. Pauli (*Helv. Chim. Acta*, 1941, **24**, 1253—1284).—A review. F. J. G.

Intermediate colloid state in the formation of gold and platinum ions. C. G. Fink (*J. Physical Chem.*, 1942, **46**, 76—81).—When Au and Pt dissolve anodically they pass through an intermediate colloid phase which can be isolated if the rate of formation of colloid from cryst. metal is > the rate of transition of colloid into metallic ion. The working conditions leading to such isolation of colloid have been investigated. Similar experiments with Cu and Ag have been unsuccessful. Possible applications of the method are discussed. C. R. H.

Study of the surface of colloidal particles of zirconium dioxide sols. I. V. A. Kargin and V. V. Kiseleva (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 377—396).—Absorption spectra of dyes adsorbed on ZrO_2 sols and in presence of various electrolytes are recorded and compared. It is concluded that the ion which determines the potential of the colloidal particles is $[Zr_2O_3,nH_2O]^{\cdot\cdot}$. F. J. G.

Depolarisation of the Tyndall-scattered light of bentonite and ferric oxide sols. C. R. Hoover, F. W. Putnam, and E. G. Wittenberg (*J. Physical Chem.*, 1942, **46**, 81—93).—An apparatus, based on the Cornu method, has been devised for determining the degree of depolarisation of the transversely scattered light of colloidal dispersions and has been tested with bentonite and Fe_2O_3 sols. The Krishnan relation is valid for both sols whether unoriented or oriented by an electric field. The application of the method to the determination of particle size is described. C. R. H.

Studies on solubilisation. R. C. Merril, jun., and J. W. McBain (*J. Physical Chem.*, 1942, **46**, 10—19).—Solubilisation is the spontaneous formation of thermodynamically stable colloidal particles of detergent and otherwise insol. material. The solubilities of Orange OT and Yellow AB in 1% solutions of anionic, cationic, and non-electrolytic detergents and of the former dye in 0·01N. solutions of colloidal electrolytes have been determined and compared. The solubilisation of liquids and the passage of solubilised dyes through semipermeable membranes are distinct from emulsification and from suspending or protective action respectively. Five theories of solubilisation are discussed. C. R. H.

Electrochemical properties of mineral membranes. II. Measurement of potassium-ion activities in colloidal clay. C. E. Marshall and W. E. Bergman (*J. Physical Chem.*, 1942, **46**, 52—61).—Using as a membrane electrode a film of electrodialysed bentonite dried at 490°, measurement of $K^{\cdot}$ activities from 0·1N. to 0·0001N. in agar and in montmorillonite (I), beidellite (II), illite (III), and kaolinite (IV) have been made. The K salt of agar behaves as a typically strong electrolyte, whereas the K salts of the clays are weaker electrolytes, the order of strength being (I) > (III) > (II) = (IV). The electrochemical behaviours of (I), (II), and (III), are similar, but (IV) differs in having a low exchange capacity and showing much less evidence of passing into true solution than the other clays. The addition of KCl and K phthalate gives no evidence of interionic

effects betweee K' associated with the clays and those added salts. C. R. H.

Mol. wts. of rubber and related materials. III. Correction. IV. Micellar theory of structure of rubber. G. Gee (*Trans. Faraday Soc.*, 1942, **38**, 108—109, 109—115).—III. Data in part II (A., 1941, I, 12) are corr.

IV. Data for the mol. wt. of rubber (I) obtained by the Rast method [micro-determination of f.p. of solutions of (I) in camphor (II)] have been made the basis of a theory of the micellar structure of (I). The dissolution of (I) in (II) at the required temp., 180°, in presence of air is shown to result in extensive degradation of (I). If the solutions are prepared in a vac. (II) shows no essential difference from other solvents of (I), all of which give apparent " mol. wts." that depend on the concn. and are nearly independent of the nature of (I) except in dil. solution. The evidence hitherto used in support of the micellar theory is therefore unsound, and the osmotic units the size of which has been previously recorded are to be considered as true macromols. F. L. U.

Constitution of three-dimensional polymerides and the theory of gelation. P. J. Flory (*J. Physical Chem.*, 1942, **46**, 132—140).—Comparison is made between the accelerating effect of pressure and temp. changes on certain gas-phase explosions and the effect of a change in the total no. of intermol. linkings on the formation of gels from three-dimensional polymerides, the distinction between gel and sol being analogous to that between a liquid and its saturated vapour. The theory is applied to the consideration of raw rubber and to protein and inorg. gels. C. R. H.

Statistical treatment of crystallisation phenomena in high polymerides. T. Alfrey and H. Mark (*J. Physical Chem.*, 1942, **46**, 112—118).—An explanation of the anomalous aspects of high-polymeride crystallisation on the basis of free energy changes in the amorphous segments is offered. The entropy of the amorphous phase depends on temp., pressure, degree of extension, and the fraction of cryst. material in the sample. The crystallisation of stretched and unstretched rubber and the spontaneous extension of rubber are explainable on the basis of the proposed theory. C. R. H.

Rigidity and moisture hysteresis in gels. W. W. Barkas (*Nature*, 1941, **148**, 690).—A correction (A., 1942, I, 144). L. S. T.

Denaturation of proteins and its apparent reversal. III. H. Neurath, G. R. Cooper, and J. O. Erickson (*J. Physical Chem.*, 1942, **46**, 203—211).—A crit. survey of available data offers no reliable evidence for strictly reversible denaturation. (Cf. A., 1942, III, 417.) C. R. H.

State of aggregation of gelatin in non-gelating systems. E. O. Kraemer (*J. Physical Chem.*, 1942, **46**, 177—182).—Recent work (cf. A., 1941, I, 262) has been extended to solutions of gelatin in 1·0M-CS$(NH_2)_2$, 8% Na salicylate, and PO_4''' buffer. The difference in the sedimentation behaviour in the different solvents is not marked. The difference between the diffusion consts. is also small except for PO_4''' buffer, the val. being very low at 20° and very high at 34·4°. Taken as a whole, the present data confirm earlier conclusions regarding mol. state and the degree of folding and coiling of the mol. C. R. H.

Electrophoresis of rabbit papilloma virus protein.—See A., 1942, III, 354.

Progressive boundary spread in electrophoresis of proteins in solution.—See A., 1942, III, 341.

Comparison of the effects of neutron and γ-ray ionisation on the electrophoretic mobility of colloidal graphite particles. L. H. Gray, J. Read, and H. Liebmann (*Brit. J. Radiol.*, 1941, **14**, 102—106).—The effects are qualitatively similar, but the amount of γ-ray ionisation required to produce a given change in electrophoretic mobility is $\gg$ that of neutron ionisation, a ratio of 8 being obtained for a particular graphite sample. Implications relative to the phenomenon itself and to the problem of the biological action of neutron rays are discussed. N. M. B.

Moving boundary methods for determination of cataphoretic speed of colloids. II. N. C. Sen-Gupta and P. R. Sinha (*J. Indian Chem. Soc.*, 1941, **18**, 489—502; cf. A., 1939, I, 78).—The Kohlrausch and Weber relation has been verified for mixtures of KCl and KIO_3 in which the conductivity of the micelle ions is comparable with those of the intermicellary electrolytes. Concordant cataphoretic speeds for two Fe_2O_3 and two Al_2O_3 sols are given by the moving boundary and the transport methods. F. R. G.

VI.—KINETIC THEORY. THERMODYNAMICS.

Equilibrium between cuprous and cupric compounds in presence of metallic copper. J. E. B. Randles (*J.C.S.*, 1942, 802—811).—The equilibrium $2Cu^{I} \rightleftharpoons Cu^{II} + Cu$ is discussed theoretically, and it is shown that with simple ionic binding the equilibrium lies far over to the right, but that covalent binding tends to favour Cu^{I}, in accordance with the known behaviour of the solid salts and their aq. solutions. Measurements on the equilibrium in anhyd. MeOH and EtOH indicate that decrease of ϵ favours Cu^{I}. Complex formation with NH_3 favours Cu^{I}, but with org. diamines favours Cu^{II}. F. J. G.

Potentiometric measurements for the determination of complex ions in cadmium salt solutions. I. Leden (*Z. physikal. Chem.*, 1941, **A, 188**, 160—181).—Complex ion formation in Cd salt solutions has been studied by a potentiometric method. The following species are indicated; CdX^{+}, CdX_2, CdX_3' (X = Cl, Br, I, CNS), $CdBr_4''$, CdI_4'', $CdNO_3^{+}$, $CdSO_4$, and probably $Cd_2Br_3^{+}$. The concn. of the various complexes as functions of the anion concn. are recorded in composition diagrams. F. J. G.

Steric hindrance. I. L. Gauditz (*Z. physikal. Chem.*, 1941, **B, 48**, 228—237).—The proportion of semi-acetal in equilibrium mixtures arising from dissolution of EtCHO in various alcohols, with or without the presence of C_7H_{16}, has been determined by measurement of their absorption in the ultra-violet spectral region. The results are discussed in relation to steric hindrance effects (cf. A., 1931, 573). J. W. S.

Disorder in the region of complexity phenomena. A. Smits (*Z. physikal. Chem.*, 1941, **B, 49**, 21—26).—Certain phenomena in the Schottky effect are in close agreement with the considerations of inner equilibria. Disorder occurs in the limiting range of complexity phenomena. Within these limiting ranges lie complexity phenomena which can be elucidated only by thermodynamic studies combined with data from infra-red and Raman spectra. W. R. A.

Elementary formulation of statistical mechanics. H. Eyring and J. Walter (*J. Chem. Educ.*, 1941, **18**, 73—78). L. S. T.

Osmotic pressure. II. H. Frahm (*Z. physikal. Chem.*, 1941, **B, 48**, 119—123; cf. A., 1940, I, 19).—Thermodynamic and kinetic considerations lead to the conclusion that the relative lowering of v.p. is independent of the vol. of the liquid phase and the no. of mols. of liquid per c.c. This is contrary to the deductions of Fredenhagen. A. J. M.

Osmotic coefficients of some organic compounds in relation to their chemical constitution. R. A. Robinson, P. K. Smith, and E. R. B. Smith (*Trans. Faraday Soc.*, 1942, **38**, 63—70).—Data are tabulated for isopiestic concns. of sucrose (I) (0·27—5·86M.) against KCl, and v.p. and osmotic coeffs. of (I) solutions are evaluated. With (I) as reference substance isopiestic measurements for solutions of *d*- and *dl*-tartaric acids and of *d*-, *l*-, and *dl*-alanine disclose no difference in the v.p. of the optically active and racemic compounds. Similar measurements with succinic, maleic, malic, and tartaric acids show that the introduction of OH causes a marked increase in the osmotic coeff. of the acid. Osmotic and activity coeffs. of Na fumarate are > those of Na maleate; this is consistent with the formation of ion-pairs in the *cis*-compound. F. L. U.

Vapour pressures and osmotic coefficients of solutions of sodium salts of fatty acids at 25°. E. R. B. Smith and R. A. Robinson (*Trans. Faraday Soc.*, 1942, **38**, 70—78).—Isopiestic data are tabulated for solutions of the Na salts of fatty acids C_1—C_{10}, the reference substance being KCl. Osmotic (ϕ) and activity coeffs. are given for molalities (m) 0·1—5·0. The data are consistent with micelle formation in $PrCO_2Na$ and the higher salts, together with association between Na^{+} and the polymerised anions. In a plot of $(1-\phi)/\sqrt{m}$ against $\sqrt{m}$ the curves for the C_6 and C_9 salts almost coincide, at the higher concns., with similar curves for $Ca(NO_3)_2$ and $K_4Fe(CN)_6$ respectively. This suggests that salts C_4—C_6 may tend to form double, and C_8—C_{10} quadruple, polymerides. F. L. U.

Properties of solutions of long-chain compounds. M. L. Huggins (*J. Physical Chem.*, 1942, **46**, 151—158).—Mathematical. Equations for the activities of the components of a solution containing chain and non-chain mols. have been derived. With their aid relations for osmotic pressure, lowering of f.p., and solubility have been derived. C. R. H.

Velocity of hydration and dehydration of nickel sulphate. B. N. Ghosh (*J. Indian Chem. Soc.*, 1941, **18**, 472—476).—The dehydration curve of $NiSO_4,7H_2O$ plotted as the no. of mols. of H_2O lost as a function of the time shows sharp changes of direction at the transition points corresponding with $NiSO_4,4H_2O$ and $NiSO_4,H_2O$. The process of hydration is more complex. F. R. G.

Zirconia–magnesia spinel system. R. F. Mather (*J. Amer. Ceram. Soc.*, 1942, **25**, 93—96).—The oxide mixtures were fired for a total of 6 hr. at 1650° and the thermal expansion, *d*, and microstructure of the product were determined. No stable compounds or solid solutions were found but an unstable solution, decomp. on repeated heating to 1300°, formed over the range 0—30% of ZrO_2. The decomp. product was an aggregate of ZrO_2 and spinel. The ZrO_2 transformation (heating curve) at 1110° was observed throughout the range of composition but transformation points on the cooling curve were lowered, by the presence of spinel, to 990° and 630° for the ZrO_2- and spinel-rich ends of the system respectively. J. A. S.

Equilibrium between vapour and liquid phases in the system CO_2–H_2O–K_2O–SiO_2. G. W. Morey and M. Fleischer (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1035—1057).—Technique and apparatus for the

separation and independent analysis of liquid and vapour phases are described. Data for the equilibrium between vapour and liquid in the system CO_2–H_2O–K_2O–SiO_2 at 500° are tabulated, and presented graphically. Partial pressures of H_2O ranged up to 400 atm., and of CO_2, up to 25 atm. The mixtures had ratios of $K_2O:SiO_2$ from 1 : 1 to 1 : 4. The distribution ratios of the fraction of CO_2 in the vapour to the ratio of the % of CO_2 to H_2O in the liquid indicate the tendency of the metasilicate melts to retain CO_2, and of the more siliceous mixtures to expel it. With a fall in pressure at const. temp. and ratio $K_2O:SiO_2$, the composition of the vapour changes towards higher $[CO_2]$. Data showing the rate of dissolution of quartz in aq. $KHCO_3$ at 340—424° for varying times are recorded. L. S. T.

Calorimetry of aqueous solutions of borax, ferrous sulphate, copper nitrate, and magnesium nitrate. J. Perreu (*Compt. rend.*, 1941, **213**, 286—289).—Thermochemical data for the dissolution of these salts in H_2O at room temp. are recorded. L. S. T.

Photometric investigation of the free energy of formation of aqueous nitrosyl chloride. H. Schmid and A. Maschka (*Z. physikal. Chem.*, 1941, **B**, **49**, 171—186).—The equilibrium of the reaction NOCl (aq.) + H_2O (l.) = HNO_2 (aq.) + HCl (aq.) has been investigated. The NOCl was determined photometrically, making use of its strong yellow colour, and the equilibrium was studied from the right-hand side by the addition of HCl to $NaNO_2$. The thermodynamic equilibrium const. at 25°, $K = (a_{HNO_2}.a_{HCl})/(a_{NOCl}.a_{H_2O}) = (0{\cdot}88 \pm 0{\cdot}04) \times 10^3$. The free energy of the reaction $\Delta G = -4019$ g.-cal. The free energy of formation of aq. NOCl at 25° is 16,015 g.-cal. A. J. M.

Heats of isomerisation of the nine heptanes. E. J. R. Prosen and F. D. Rossini (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 519—528; cf. A., 1942, I, 24).—The heats of isomerisation in the liquid state at 298° K. and in the gas at 298° and 0° K. have been calc. for β- and γ-methylhexane from the corresponding vals. for the isomerisation of *n*-hexane into β- and γ-methylpentane and of *n*-octane into β- and γ-methylheptane. Similar data for the other heptanes have been determined from their heats of combustion in the liquid state. J. W. S.

Free energies and equilibria of isomerisation of the butanes, pentanes, hexanes, and heptanes. F. D. Rossini, E. J. R. Prosen, and K. S. Pitzer (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 529—541).—The function $\Delta G^\circ/T$ (ΔG° = standard free energy of isomerisation) and the relative amounts of the several isomerides present at equilibrium are calc. for all C_4H_{10}, C_5H_{12}, C_6H_{14}, and C_7H_{16} isomerides. For mixtures containing the two butanes, two pentanes, or four hexanes the results are in accord with directly measured equilibrium concns. At 25° the *n*-isomeride is thermodynamically the least stable in each case, excepting that γ-ethylpentane is less stable than *n*-C_7H_{16}, whilst the ββ-Me_2 isomeride is the most stable. Relative to the other isomeride the *n*- and ββ-dimethyl-isomerides increase and decrease in stability, respectively, with rising temp., till at 1000° K. they are among the most stable and least stable isomerides, respectively. J. W. S.

VII.—ELECTROCHEMISTRY.

Electrical conductivities of aqueous solutions of some phenanthrene-sulphonic acids. T. R. Bolam and J. Hope (*J.C.S.*, 1941, 843—849).—Λ and ρ for aq. solutions of *p*-$C_6H_4Me{\cdot}SO_3H$ (**I**), phenanthrene-2- and -3-sulphonic acid, 9-chloro- and 9-bromo-phenanthrene-3-sulphonic acid have been determined at 18° and 25° over a wide range of concn. (**I**) behaves throughout as a simple strong electrolyte. Λ for the other acids agrees with the Onsager theory at sufficiently high dilution, but micelle formation occurs at higher concn. F. J. G.

Relation of electromotive force to the concentration of deuterium oxide in saturated standard [cadmium] cells. L. H. Brickwedde and G. W. Vinal (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 479—489).—Previous measurements (A., 1938, I, 402) have been extended to standard Weston cells containing up to 98-mol.-% of D_2O. Over the range 0—50 mol.-% D_2O the e.m.f. is decreased by 3·6 μv. per mol.-% of D_2O, but the decrease is slightly greater with >50 mol.-% D_2O, the e.m.f. in 98 mol.-% D_2O being 388 μv. < in normal H_2O. The temp. coeff. is almost independent of the D_2O content and evidence is obtained that with high D_2O contents the hysteresis is slightly <, and the cell resistance slightly >, in normal H_2O. During 4 years the constancy of the cells was equal. The difference between the partial mol. free energy of $CdSO_4$ in H_2O and in D_2O is calc. J. W. S.

Electrode polarisation. Automatic control of potential of a working electrode.—See A., 1942, I, 157.

Effect of surface-active agents on electro-organic reductions. C. W. Proudfit and W. G. France (*J. Physical Chem.*, 1942, **46**, 42—51).—The effect of various types of wetting agents on the reduction of the depolarisers COPhMe, $CCl_3{\cdot}NO_2$, pyrrole, *o*-$C_6H_4Me{\cdot}NO_2$, *m*- and *p*-tolualdehyde, and anisaldehyde is to decrease the current efficiency (*C*) of the process, the greatest lowering being observed with those wetting agents which are efficient foam producers. Changes in *C* with increase in concn. of wetting agent conform to three types: (1) gradual reduction of *C* in the case of moderately strong wetting agents of the anion-active type; (2) decrease in *C* followed by a rise in the case of strong wetting agents of the anion-active type; (3) rapid decrease in *C* followed by const. *C* with strong wetting agents of the cation-active type. The effects of anion-active and cation-active wetting agents are respectively attributed to the ability to stabilise emulsions of org. liquids in aq. solutions, and the saturation of the cathode surface by low concns. of wetting agent which partially excludes the depolariser from the reducing zone of the cathode. C. R. H.

VIII.—REACTIONS.

Kinetics of the thermal decomposition of straight-chain paraffins. R. E. Burk, L. Laskowski, and H. P. Lankelma (*J. Amer. Chem. Soc.*, 1941, **63**, 3248—3250).—The constancy of the calc. energies of activation for the thermal decomp. of *n*-paraffins on the basis of scission of C–C bonds to form an olefine and a new hydrocarbon (A., 1931, 1131) is taken to corroborate the mechanism. A simplified chain mechanism is considered but it predicts a rate of decomp. ≫ the experimental rate. W. R. A.

Reaction rates of oxidation of liquid acetaldehyde.—See B., 1942, II, 89.

Influence of hydroxyl ion concentration on the autoxidation of quinol. J. R. Green and G. E. K. Branch (*J. Amer. Chem. Soc.*, 1941, **63**, 3441—3444).—The expression $-d(O_2)/dt = k[O_2][C_6H_4(OH)_2][OH']^{3/2}$ (A., 1924, i, 281) for the rate of autoxidation of quinol has been confirmed and a chain mechanism has been proposed for the reaction. W. R. A.

Surface phenomena in the recrystallisation of supercooled liquids in thin layers. III. G. L. Mischnevitsch and I. Brovko (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 444—446; cf. A., 1940, I, 110).—The curve of rate of formation of nuclei in supercooled Betol (in a thin film between glass plates) against temp. usually shows two max., but after treatment of the plates with HF only one max. remains. F. J. G.

Influence of low-frequency elastic vibrations on the crystallisation of a supercooled organic liquid. I. G. L. Mischnevitsch and P. I. Dombrovski (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 437—443).—Low-frequency (sound) vibrations diminish both the rate of formation of nuclei and the rate of their growth in the recrystallisation of undercooled Betol, and the effect persists for a time after the sound is cut off. F. J. G.

Thermal decomposition of acetone catalysed by iodine. G. M. Gantz and W. D. Walters (*J. Amer. Chem. Soc.*, 1941, **63**, 3412—3419; cf. A., 1940, **I**, 261).—The homogeneous thermal decomp. of $COMe_2$ is catalysed by I. The products have been analysed and from the analyses and the pressure increase it is concluded that the overall reaction is $COMe_2 = 1{\cdot}5CH_4 + CO + 0{\cdot}5C$. The decomp. is retarded by NO, C_2H_6, and C_2H_4. The effect of adding MeI was comparable to that of I; EtI was less effective, and Prβ1 had practically no effect. As the pressure of I is increased the catalytic effect increases to a max. and then decreases to a const. val. I catalyses the decomp. of COMeEt, $COEt_2$, Ac_2, dioxan, and tetrahydrofuran. From spectroscopic observations I disappears for a period during the decomp. W. R. A.

Acid catalysis in relation to concentration and activity of hydrogen ions. M. Duboux [with Rochat, Favre, Matavulj, Jaccard, and de Souza] (*Bull. Soc. vaud. Sci. nat.*, 1937, **59**, 279—320; *Chem. Zentr.*, 1938, ii, 3908).—The rates of inversion of sucrose (**I**) and decomp. of $CHN_2{\cdot}CO_2Et$ have been determined in org. solvents at 25° and 75°, in presence of various org. acids and their salts. The val. of the const. k_H in $k = k_H[H^+]$ increases with the concn. (*c*) of the catalysing acid, and reference must be made to the relation between k_H and *c* if $[H^+]$ is to be determined to within 1—3% by measurement of *k*. A study of the inversion of (**I**) at 25°, in aq. HCl or aq. HCl containing NaCl, NH_4Cl, or $MgCl_2$, shows that the relation $k = k'_H a_H$ is followed with moderate accuracy. A. J. E. W.

Acid-catalysed hydrolysis of ethyl esters of aliphatic acids. H. A. Smith and J. H. Steele (*J. Amer. Chem. Soc.*, 1941, **63**, 3466—3469).—The kinetics of acid-catalysed hydrolysis in 70% $COMe_2$ has been investigated for Et *n*- and *iso*-butyrate, *n*- and *iso*-hexoate, *n*-nonoate, β-methylvalerate, and *cyclo*hexanecarboxylate. The effects of the character of an alkyl group are similar on the rate of acid- and base-catalysed hydrolysis of esters of aliphatic acids and on the rate of acid-catalysed esterification of the corresponding acids. W. R. A.

Base-catalysed decomposition of nitramide in aqueous solution. L. K. J. Tong and A. R. Olson (*J. Amer. Chem. Soc.*, 1941, **63**, 3406—3411).—The rate coeffs. for the decomp. of nitramide in aq. solutions containing the following ions have been measured: OH', OPh', 2 : 4-dichloro-, 2 : 4-dinitro-, *o*-nitro-phenoxide, OBz', CN', and nitramide. The curve of log sp. rate of catalysis–log basic

const. of catalyst agrees with that postulated by Brønsted and Pedersen (A., 1924, ii, 306). W. R. A.

Effect of solvent on some reaction rates. F. H. Westheimer and W. A. Jones (*J. Amer. Chem. Soc.*, 1941, **63**, 3283—3286).—The rate of amine-catalysed dealdolisation (i) of diacetone alcohol, and the rates of uncatalysed (ii) and amine-catalysed decarboxylation of $CMe_2Ac{\cdot}CO_2H$ have been measured in H_2O–EtOH and H_2O–dioxan. Since (i) and (ii) are independent of solvent the rate-determining step cannot be the decomp. of a dipolar ion or other highly polar intermediate. Possible mechanisms are discussed. W. R. A.

Kinetics of the tervalent vanadium–oxygen reaction. J. B. Ramsey, R. Sugimoto, and H. DeVorkin (*J. Amer. Chem. Soc.*, 1941, **63**, 3480—3486).—The reaction between $V^{...}$ ions and O_2 has been investigated alone and in the presence of $Cu^{..}$ and possible mechanisms have been proposed. Crit. increments have been determined. The different rate vals. obtained for the uncatalysed reaction are attributed to variation in the "dust particle" content of different stock solutions of $V^{...}$ ions. The rate of the uncatalysed reaction is independent of salt concn. but the Cu-catalysed reaction has a positive salt effect at ionic strengths from 0·1 to 1·0. A mechanism of the induced catalysis of the O_2–I' reaction is suggested. O_2, Cu, and I react with hydrolysed V^{III} at a measurable rate. W. R. A.

Influence of halides on oxidation of ascorbic acid.—See A., 1942, III, 329.

Magnetism and catalysis. III. Chlorination of chloroform to carbon tetrachloride in presence of ferric chloride. S. S. Bhatnagar, N. A. Yajnik, P. L. Kapur, and A. S. Bhatnagar (*J. Indian Chem. Soc.*, 1941, **18**, 350—358).—The chlorination of $CHCl_3$ is accelerated by H_2O, but that of moist $CHCl_3$ is retarded by $FeCl_3$, and χ for the mixture is < calc. for additivity, suggesting that $FeCl_3$ reacts with H_2O forming $Fe(OH)_3$ and that this is the inhibitor. F. J. G.

Magnetism and catalysis. IV. Catalysis of the reaction between ammonium oxalate and mercuric chloride by ferric ions. S. S. Bhatnagar, P. L. Kapur, A. S. Bhatnagar, and B. Prakash (*J. Indian Chem. Soc.*, 1941, **18**, 371—374).—During the photochemical reaction between $HgCl_2$ and $(NH_4)_2C_2O_4$ in presence of $FeCl_3$, χ deviates slightly from the mixture law, indicating the formation of an intermediate compound. F. J. G.

Magnetism and catalysis. V. Catalytic decomposition of potassium chlorate by cobaltosic oxide and ferromagnetic variety of ferric oxide. S. S. Bhatnagar, P. L. Kapur, A. S. Bhatnagar, and M. A. Qayyum (*J. Indian Chem. Soc.*, 1941, **18**, 391—396; cf. A., 1940, I, 261).—χ for the products of decomp. of $KClO_3$ catalysed by Co_3O_4 is < χ of the sum of the separate constituents, indicating that there is intermediate formation of Co_2O_3 thus: $2KClO_3 + 12Co_3O_4 \rightarrow [2KCl + 12Co_3O_4 + 3O_2 \rightarrow 2KCl + 18Co_2O_3] \rightarrow 2KCl + 12Co_3O_4 + 3O_2$. The spontaneous decomp. temp. of $KClO_3$ with magnetic Fe_2O_3 is 330° compared with 350° for non-magnetic Fe_2O_3, indicating that the former is a better catalyst. F. R. G.

Catalytic decomposition of ammonia over iron synthetic ammonia catalysts. (Miss) K. S. Love and P. H. Emmett (*J. Amer. Chem. Soc.*, 1941, **63**, 3297—3308).—The decomp. of NH_3 over 3 Fe catalysts has been studied. The kinetics of the reaction over catalyst 931 (1·3% Al_2O_3, 1·59% K_2O) differ markedly from those of the reaction over catalysts 954 (10·2% Al_2O_3) and 973 (0·15% Al_2O_3). The reaction over catalyst 931 $\propto p_{NH_3}^{0\cdot6}/p_{H_2}^{0\cdot85}$, with an apparent energy of activation of 45,600±2000 g.-cal. The reaction kinetics over catalysts 954 and 973 are similar and the rates $\propto p_{H_2}$ and $1/p_{NH_3}$ for a considerable range of temp. Possible explanations are advanced. W. R. A.

Vapour-phase partial oxidation of ethyl alcohol. L. R. Michels and D. B. Keyes (*Ind. Eng. Chem.*, 1942, **34**, 138—146).—A quant. study of the vapour-phase oxidation of EtOH and its oxidation products has been made. Using a platinised SiO_2 aerogel catalyst, conversion into MeCHO increases with decrease in the velocity (v) of EtOH over the catalyst, and the optimum ratio (r) of air to EtOH increases with increase in v. High CO_2 yields are obtained with high vals. of r. Dehydrogenation of EtOH can account for only a small proportion of the MeCHO formed during oxidation. H_2O and AcOH have only a small effect on the oxidation. The varying effect of EtOH and of H_2O on the oxidation of MeCHO at different catalyst temp., and the influence of catalyst temp. on the oxidation of AcOH and CO have similarly been investigated. Experiments with plain SiO_2 catalysts have shown that the effect of Pt is to increase the conversion of EtOH into MeCHO and CO_2 and to decrease the conversion into AcOH, H_2, and CO. No general theory appears able to explain the complex mechanisms involved in the oxidation. C. R. H.

Catalytic dehydrogenation and condensation of aliphatic alcohols. II.—See A., 1942, II, 127.

Catalysts for the polymerisation of benzyl chloride. O. C. Dermer and E. Hooper (*J. Amer. Chem. Soc.*, 1941, **63**, 3525—3526).—The polymerisation of CH_2PhCl is catalysed by $AlCl_3$, $SbCl_5$, BCl_3, $CdCl_2$, $NbCl_5$, $FeCl_3$, Ga, In (both added as metal), $MnCl_2$, $MoCl_5$, $PdCl_2$, $PtCl_4$, $SnCl_4$, $SnCl_2$, $TaCl_5$, $TiCl_4$, WCl_6, uranyl acetate, and $ZnCl_2$, giving thermoplastic resins in approx. theoretical yield. Small amounts of polymeride were produced in presence of $AuCl_3$, $BaCl_2$, $CoCl_2$, $CuCl_2$, $LaCl_3$, $NiCl_2$, $SeCl_4$, and $TeCl_2$. No solid polymeride was formed with $SbCl_3$, $AsCl_3$, $BiCl_3$, $CaCl_2$, $CeCl_4$, $CrCl_3$, ICl_3, $PbCl_2$, $MgCl_2$, $HgCl_2$, PCl_3, PCl_5, $AgCl$, $SrCl_2$, S_2Cl_2, $TeCl_4$, $TlCl_3$, and $ThCl_4$. W. R. A.

Applicability of palladium synthetic high polymer catalysts. L. D. Rampino and F. F. Nord (*J. Amer. Chem. Soc.*, 1941, **63**, 3268).—The superiority of the synthetic Pd and Pt catalysts (A., 1942, I, 150) has been shown in the hydrogenation of benzil, m-$C_6H_4Br{\cdot}NO_2$, chaulmoogric acid, cinnamaldehyde, furfuraldehyde, $CH_2{:}C{\cdot}CO_2H$, and quinol. W. R. A.

Use of amalgamated aluminium as catalyst in the Friedel-Crafts reaction.—See A., 1942, II, 136.

Influence of behaviour of thiophen on aromatisation catalysts.—See B., 1942, II, 137.

Catalytic mullitisation of kaolinite by metallic oxides.—See B., 1942, I, 195.

Electrolytic production of ozone and anodic overvoltage. E. Briner and A. Yalda (*Helv. Chim. Acta.*, 1941, **24**, 1328—1345).—Yields of up to 11·6 g. of O_3 per kw.-hr. may be obtained by the electrolysis of H_2SO_4 of the eutectic composition at −40° to −50°. The yields increase with increasing anodic overvoltage, and there is a parallelism between overvoltage and the potential of an O_2–O_3 electrode. F. J. G.

Perborate formation at a rotating anode. J. L. Culbertson and W. C. Teach (*Trans. Electrochem. Soc.*, 1942, **81**, *Preprint* 4, 33—39).—The efficiency (a) of $NaBO_3$ formation at a rotating Pt anode increases to a max. and then diminishes as the rotational speed (V) increases. For a given val. of V, a decreases continually with duration of the reaction. The val. of V at which max. a is attained in a given time interval decreases as the time interval increases. The data are examined in the light of existing theories. C. R. H.

Oxidation of cerous sulphate at a rotating anode. J. L. Culbertson and C. Rutkowski (*Trans. Electrochem. Soc.*, 1942, **81**, *Preprint* 3, 27—32).—The effect on the anodic oxidation of $Ce_2(SO_4)_3$ of varying the speed of rotation of the anode over the range 0—5100 r.p.m. has been investigated. If other factors are kept const., current efficiency (a) increases with increase in speed of rotation according to $\log(a - a_0) \propto \log V$, where a_0 is the current efficiency at a stationary electrode and V is the linear velocity of the surface of the electrode. This relation breaks down as a approaches 1, since V may increase without limit. Since the relation is of the same type and order of magnitude as the heat transfer coeff. for a liquid film and since heat transfer is diffusion-controlled, diffusion control of the electrolytic reaction is indicated. C. R. H.

Electrolysis of rare-earth acetates and separation of europium as amalgam from other rare earths. H. N. McCoy (*J. Amer. Chem. Soc.*, 1941, **63**, 3432—3433).—By the electrolysis of aq. K citrate solutions of Eu, Yb, and Sm acetates between a heavy Pt wire anode and a Hg cathode amalgams are formed. Amalgams are also formed when aq. K citrate solutions of Eu, Yb, and Sm acetates are stirred with K amalgam. Other rare earths treated similarly gave no amalgams. It is possible that Eu and Yb can be separated from accompanying rare earths by their amalgams, the Eu amalgam being formed more readily than the Yb amalgam. W. R. A.

Electrolytic solution of sodium hypochlorite.—See A., 1942, III, 280.

Effect of inorganic colloids on electrodeposition of nickel on copper.—See B., 1942, I, 201.

Cathodic protection of aluminium equipment.—See B., 1942, I, 204.

Electrolytic preparation of ethyl glyoxylate.—See A., 1942, II, 130.

Decomposition of hydrogen peroxide by sodium nitroprusside. B. B. Lal (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 652—669).—The decomp. of H_2O_2 by $Na_2Fe(CN)_5NO$ (**I**) is negligibly slow in the dark, but if the mixture is previously insolated then, in the dark, decomp. is autocatalytic. In presence of $K_4Fe(CN)_6$ (**II**) decomp. is unimol. and more rapid. Evidently the catalyst formed during insolation is changed into a more reactive substance by interaction with (**II**) and is kept at a const. concn. when (**II**) is in excess. If fresh H_2O_2 is added in the dark to the end products of the reaction an autocatalytic reaction takes place similar to that observed with pre-insolated (**I**). The catalyst is $Na_2Fe(CN)_5H_2O$ (**III**) which is reduced by (**II**) to $Na_3Fe(CN)_5H_2O$ which is highly reactive towards H_2O_2. The photochemical after-effect is suppressed by CN' and NO_2' which convert (**III**) into $Na_4Fe(CN)_6$ and (**I**), respectively. C. R. H.

Photosensitisation by solids. III. Photosensitised oxidation of ammonia in aqueous solution with colloidal titania as the photosensitiser. G. Gopalarao and C. I. Varadanam (*J. Indian Chem. Soc.*, 1941, **18**, 361—370).—The rate of reaction in presence of

negatively charged TiO_3 sol is independent of $[NH_3]$ and is decreased by addition of coagulating electrolytes, indicating that the reaction occurs on the surface of the photosensitiser. The probable mechanism is discussed. F. J. G.

Photographic factors influencing the concentration–calibration curve in quantitative methods of spectrochemical analysis. I. Photographic intensity ratios as an expression of intensity ratios of lines in a light source. II. Failure of the reciprocity law and intensity retardation of development effect. L. W. Strock (*Spectrochim. Acta*, 1939, **1**, 117—122, 123—130).—**I.** " Photographic intensity (I) ratios " determined by comparison of the photographic effects of spectrum lines differ from true I ratios owing to failure of the reciprocity law. The effects of such failure are considered with reference to photographic density–log (exposure) curves with " I scales " (obtained with const. exposure time and a stepped filter) or " time scales " (obtained with const. I and a rotating stepped sector). In either case the photographic I ratio must be calibrated empirically against concn. in spectrographic analysis.

II. The effects of reciprocity failure and the intensity retardation of development effect on concn.–calibration curves are separately examined, and a non-linear theoretical curve is obtained which resembles typical experimental curves. In spectrographic analysis const. development conditions are essential, even when internal standards are used. A calibration curve should be made for each emulsion. Empirical calibration curves should not be extrapolated beyond experimental points. A. J. E. W.

Photographic factors influencing the concentration–calibration curve in quantitative methods of spectrochemical analysis. I. Photographic intensity ratios as an expression of intensity ratios of lines in a light source. L. W. Strock (*Spectrochim. Acta*, 1940, **1**, 374).—A correction (cf. preceding abstract). J. W. S.

Number of quanta required to form the photographic latent image.—See B., 1942, II, 127, 175.

Distribution of the latent image in the silver bromide grain.—See B., 1942, II, 175.

Photolysis of methyl bromide. A. Gordon and H. A. Taylor (*J. Amer. Chem. Soc.*, 1941, **63**, 3435—3441).—The photolysis of MeBr by 2537 A. gives a quantum yield, based on Br produced, of 4×10^{-3}. The principal products are Br, CH_4, and CO and the following mechanism is suggested: $MeBr + h\nu \rightarrow Me + Br$; $Me + MeBr \rightarrow CH_4 + CH_2Br$; $Me + MeBr \rightarrow C_2H_6 + Br$; $Me + Br \rightarrow MeBr$. In the presence of NO a complex reaction occurs and NOBr, N_2, oxides of N, and CO are formed. The quantum yield on the basis of NOBr produced is ~1. In the presence of Ag the quantum yield, based on CH_4 produced, is ~1 and only CH_4 and CO are formed. The difference of ~6 kg.-cal. in the energies of activation for the production of CH_4 and C_2H_6 accounts for the absence of C_2H_6. CO is formed probably by reaction between CH_2Br and SiO_2. Increase of temp. to 250° does not alter qualitatively the above results. W. R. A.

Photochemical studies. XXXIII. Photochemical decomposition of acetone in the presence of an inert gas. J. J. Howland, jun., and W. A. Noyes, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3404—3406).—Addition of several hundred mm. of CO_2 to $COMe_2$ produces a marked increase in the amount of CO formed by the photochemical decomp. of $COMe_2$ at low intensities, but the effect at high intensities is the production of less CO and of more Ac_2. CO appears to be produced principally by the homogeneous decomp. of $MeCO \rightarrow Me + CO$ and only very slightly by a primary process. Production of Ac_2 at low intensities appears to be largely a wall reaction. At higher intensities and higher pressure Ac_2 formation become increasingly a homogeneous gas phase reaction. W. R. A.

Photolysis of keten in the presence of hydrogen and methane. C. Rosenblum (*J. Amer. Chem. Soc.*, 1941, **63**, 3322—3329).—The photodecomp. of keten by ultra-violet light at ~45° is independent of the nature of subsequent reactions. This supports the view that CH_2 radicals are produced by the absorption of radiation. In the presence of H_2 saturated compounds are formed possibly by reaction between CH_2 and H_2 yielding Me and H at the same time as CH_2 combines to give C_2H_4. Saturated compounds are also formed in the presence of CH_4, owing, presumably, to the reaction between CH_2 and CH_4 yielding Me radicals. W. R. A.

Photochemical oxidation of chloral sensitised by bromine. J. Stauff and H. J. Schumacher (*Z. physikal. Chem.*, 1941, **B**, **48**, 154—175).—The photochemical oxidation of CCl_3·CHO in the presence of Br has been investigated at 70—90°. The reaction is a chain reaction, which has a quantum yield of 8 mols. per $h\nu$ at 100 mm. total pressure, and for the absorption of light at the rate of $3{\cdot}3 \times 10^{13}$ $h\nu$ per c.c. per sec. The products are $COCl_2$, CO, HCl, BrCl, H_2O, and probably a small quantity of CCl_3·COBr. The chain can be represented by 12 equations. An expression is obtained for the velocity of formation of $COCl_2$. The temp. coeff. for a temp. interval of 10° is 1·30, giving an activation of energy of 6·5 kg.-cal. A. J. M.

Photochemical studies of rancidity. Chlorophyll value in relation to autoxidation.—See B., 1942, II, 112.

Molecular rearrangement induced by ultrasonic waves. E. W. Barrett and C. W. Porter (*J. Amer. Chem. Soc.*, 1941, **63**, 3434—3435).—The rate of rearrangement of benzazide in NH_2Ph has been studied at 16, 275, and 478 kc. per sec. with power inputs from 100—250 w. The rate is independent of frequency but ∝ the energy of vibration (cf. A., 1938, I, 419). W. R. A.

IX.—METHODS OF PREPARATION.

Synthetic optical crystals. H. C. Kremers (*Ind. Eng. Chem.*, 1941, **32**, 1478—1483).—The modern method of producing large synthetic LiF, NaCl, KBr, KI, and $NaNO_3$ crystals by lowering the crucible containing the molten salt slowly through tube furnaces at suitable temp. and the methods of cutting the crystals to produce prisms etc. are described. The optical characteristics of the crystals are discussed. The methods is particularly applicable to LiF, which can be substituted for CaF_2 in ultra-violet spectroscopy. J. W. S.

Hydrated lithium aluminium sulphate (lithium alum). H. A. Horan and J. J. Duane (*J. Amer. Chem. Soc.*, 1941, **63**, 3533—3534).—Additional work on the system Li_2SO_4–$Al_2(SO_4)_3$–H_2O at 0° (A., 1939, I, 612) indicates the existence of a double salt, approx. $LiAl(SO_4)_2,12H_2O$. W. R. A.

Dehydration of hydrated crystals by boiling non-aqueous liquids. R. B. Trusler (*Oil and Soap*, 1941, **19**, 1—3).—Many hydrated salts of org. or inorg. acids [*e.g.*, $Na_2SO_4,10H_2O$, $Zn(OAc)_2$, Na silicates, borates, etc., $CaCl_2$] can be dehydrated at < air-drying temp. by immersion in a boiling, distilling, non-aq. liquid—some at relatively low temp., *e.g.*, with CH_2Cl_2, Pr^{β}_2O (Et_2O is ineffective); others, *e.g.*, $K_2C_2O_4,H_2O$, are unaffected by C_6H_6 but dehydrated by boiling PhMe. $CuSO_4,5H_2O$ loses 4 H_2O in boiling PhMe, but requires tetralin to remove the remaining H_2O. In the experiments detailed, a Bidwell–Stirling or A.S.T.M. receiver was used, the H_2O driven off being measured volumetrically. In some cases residual salts containing H_2O of crystallisation corresponding with unusual states of hydration could be obtained. In determining H_2O by the distillation method in soaps containing hydrated salts, the actual degree of dehydration of such salts which can be procured under the experimental conditions must be taken into account. The method can also be applied to determine the original state of hydration of normally hydrated crystals which have been partly dried. E. L.

4-Co-ordinated mercuric salts with diamines, and a new method of determining mercury. K. L. Mandal (*Current Sci.*, 1941, **10**, 522—523).—Bis-ethylenediamine-mercuric chloride, a 4-co-ordinated Hg^{II} halide, does not exist in the pure state in the solid form. $HgCl_2$ and $HgBr_2$ form white mono-compounds with equimol. proportions of $(CH_2{\cdot}NH_2)_2$ (**I**), which are insol. They dissolve in excess of (**I**) giving H_2O-sol. products, but pure bis-ethylenediamine-mercuric halides cannot be obtained from them. Washing with EtOH or crystallising from H_2O converts them into the insol. mono-compounds. *Bis-ethylenediamine-mercuric chloroplatinate* (**I**) and *bis-ethylenediamine-mercuric salts* of oxyacids have been prepared. (**II**) is insol. in H_2O, and is unaffected when kept over H_2SO_4. This forms the basis of a method of determining Hg. Propylenediamine can be used in place of (**I**). A. J. M.

Two lower oxides of boron. R. C. Ray and P. C. Sinha (*J.C.S.*, 1941, 742—744).—The residue after repeated extraction of Mg_3B_2 by H_2O reacts slowly with conc. aq. NH_3 in an atm. of H_2 to yield *compounds* $(NH_4)_2B_2(OH)_2$ (**I**) and $(NH_4)_2B_4O_4$ (**II**) which are stable when dry at <0°. Neither compound reacts with dil. H_2SO_4 and (**I**) gives no ppt. with Ba, Ca, or Mg salts but (**II**) yields white cryst. ppts. with these salts. On heating (**I**) yields NH_3 and H_2, whilst (**II**) gives NH_3 only, the residues comprising the *oxides* B_2O_3 (slightly brown) and B_4O_5 (colourless), respectively. Both oxides dissolve in H_2O to give colourless solutions which on evaporation yield the *acids* $H_4B_2O_4$ and $H_2B_4O_6$, these on heating in a vac. giving the pure oxides. The solutions are oxidised slowly in air and also by $KMnO_4$ to H_3BO_3. The *compounds* $Mg_2B_2O_4$, $Ba_2B_2O_4$, MgB_4O_6, and BaB_4O_6 have also been prepared by the interaction of the metal hydroxides and solutions of the acids in a vac. J. W. S.

Hydration of aluminium sulphate.—See A., 1942, I, 145.

Formation of complex fluorides in anhydrous liquid hydrogen fluoride. I. Sodium fluoniobates. A. W. Laubengayer and C. G. Polzer (*J. Amer. Chem. Soc.*, 1941, **63**, 3264—3266).—Na fluoniobates are formed by crystallisation from solutions in anhyd. H_2F_2 of NaF and NbF_5 in mol. ratios varying from 0·5 : 1 to 20 : 1. At 1 : 1 ratios pure *Na hexafluoniobate*, $NaNbF_6$, is formed; at higher ratios *Na heptafluoniobate*, Na_2NbF_7, and $NaHF_2$ are formed, but no Na_3NbF_8. $NaNbF_6$ has ρ^{25} 2·71±0·01, is unstable in air, hydrolysed by H_2O, reacts with H_2O, and is insol. in C_6H_4. When N_2 is passed over it and the temp. raised slowly (2° per min.) $NaNbF_6$ is stable up to 480° but at >480° it decomposes without melting into NaF and NbF_5. Na_2NbF_7 has ρ^{25} 3·47±0·01, poorly-formed, biaxial, monoclinic or orthorhombic crystals, unstable in air, rapidly hydrolysed by H_2O, insol. in C_6H_6. When heated in

dry N_2 it melted at 530±10° and then decomposed into NaF and NbF_5. W. R. A.

Composition and constitution of paramolybdates. P. Rây and S. K. Siddhanta (*J. Indian Chem. Soc.*, 1941, **18**, 397—406).—Analysis, dehydration, and rehydration of $[Co(dgH)_3]_2Mo_7O_{24},9H_2O$; $[Cu(dgH)_2]_3Mo_7O_{24},H_2O$; $[Ni(dgH)_2]_2R_2Mo_7O_{24},4H_2O$ (R = NH_4 or Na; dg H = diguanide, $C_2H_7N_5$) support the formula $3R_2O,7MoO_3$, aq. for the paramolybdates and $[Mo_7O_{24}]^{VI}$ for the ion. F. R. G.

Preparation of constant-boiling hydrochloric acid. Rate of approach to equilibrium. A. C. Titus and D. E. Smith (*J. Amer. Chem. Soc.*, 1941, **63**, 3266—3267).—From measurements of ρ for distillate fractions of HCl it is concluded (i) that it is safe to discard two thirds of the distillate and keep the remaining one third, if the initial ρ is ~1·10, (ii) that the equilibrium ρ^{25} at 647 mm. is 1·0975, and (iii) that equilibrium is more slowly attained starting with dil. acid (*e.g.*, ρ = 1·06). W. R. A.

Interaction of chloramine-*T* and hydrogen sulphide, phosphine, and arsine. J. R. Bendall, F. G. Mann, and D. Purdie (*J.C.S.*, 1942, 157—163).—Aq. chloramine-*T* (I) and H_2S or Na_2S at room temp. give *p*-$C_6H_4Me{\cdot}SO_2{\cdot}NH_2$ (II), together with H_2SO_4 or S, respectively; H_2S added to (I), with KI–starch as internal indicator, however, affords S, due probably to quick oxidation of KI. Sulphites can be determined volumetrically by (I), which converts them at room temp. into sulphates and (II); $Na_2S_2O_3 \rightarrow Na_2S_4O_6$ + (II), similarly. PH_3 (in excess) reacts more slowly with (I), when H_2PO_3 and H_3PO_3 are formed, but no H_3PO_4; when (I) is in excess, however, there is slow oxidation to H_3PO_4. Na_2HPO_3 and excess of (I) at 28·5° (24 hr.) do not react appreciably, but addition of 2 equivs. of AcOH, to produce an equilibrium with NaOAc and H_2PO_3 causes complete oxidation in 1 hr. NaH_2PO_2 and excess of (I) react slowly, through NaH_2PO_3, rapidly to NaH_2PO_4. PH_3 is oxidised to H_3PO_4 through stages: (rapid) $H_3PO_2 \rightarrow$ (slow) $H_3PO_3 \rightarrow$ (rapid) H_3PO_4. AsH_3 passed into (I) at 28·5° affords H_3AsO_4 (96·5% after 1 hr.), probably through H_3AsO_3, which is oxidised rapidly. A. T. P.

Behaviour of rhenium and of the complex thiocyanates of rhenium and molybdenum with toluene-3 : 4-dithiol. C. C. Miller (*J.C.S.*, 1941, 792).—Re (as ReO_4') forms with toluene-3 : 4-dithiol ("dithiol") a green complex similar to those produced by Mo and W, but unlike the latter its formation is favoured by the use of 11N-HCl. In presence of Bu^tOAc all yield the complex in 11N-HCl, but on warming with KCNS the Re solution turns red-brown. The complex $Mo(OH)_2(CNS)_3$ on heating with HCl and dithiol yields the green dithiol complex but similar treatment of $ReO(CNS)_4$ causes only a deepening of the colour to red-brown. J. W. S.

Action of chlorine on the hydroxides of iron and chromium in presence of iodine. R. K. Bahl and M. Lal (*J. Indian Chem. Soc.*, 1941, **18**, 359—360).—$FeIO_5,11H_2O$ and $Cr_2O_3,2I_2O_7,22H_2O$ are formed by the action of Cl_2 on aq. suspensions of I and $Fe(OH)_3$ or $Cr(OH)_3$. F. J. G.

X.—ANALYSIS.

Spectrochemical analysis by the stepped sector method. R. Breckpot (*Spectrochim. Acta*, 1939, **1**, 137—163).—A detailed description and theoretical discussion of the method, which extends the range of application of the Gerlach internal standard method, are given. The calibration curve of the photographic plate for each spectrum line is automatically obtained, and frequent reference to standard specimens is obviated. The method is almost independent of plate or development factors, and can be applied visually or photometrically. Devices are described for the rapid calculation of results from data derived from the spectrograms. A. J. E. W.

Spectrum-analytical determination of metals in microscopical preparations. W. Gerlach (*Spectrochim. Acta*, 1939, **1**, 168—172).—The cut section is placed in a cavity in the lower electrode of an intermittent d.c. arc; specially purified C rods impregnated with NaCl are employed. Typical spectrograms showing the presence of heavy metals in liver and gum tissue sections are reproduced. The method is capable of quant. application, and is ~100 times as sensitive as high-frequency spark methods. A. J. E. W.

Photographic factors influencing the concentration-calibration curve in quantitative methods of spectrochemical analysis.—See A., 1942, I, 179.

Micro-analysis. G. H. Wyatt (*Chem. and Ind.*, 1942, 132—134).—A brief review.

Polarographic method of analysis. I, II. O. H. Müller (*J. Chem. Educ.*, 1941, **18**, 65—72, 111—115).—I. A general review of electroanalytical methods.

II. Apparatus and manipulation in polarographic analysis are described. L. S. T.

Titration of bromide and iodide ions with mercuric nitrate solution using diphenylcarbazide as indicator. H. R. McCleary (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 31—32).—The solution is neutralised with NaOH (phenolphthalein), and sufficient 0·2N-HNO_3 added so that the final solution after titration contains the equiv. of 5 c.c. of 0·2N-acid. 8 c.c. of peroxide-free dioxan (I) are added followed by 0·025N-$Hg(NO_3)_2$ to within 2 or 3 c.c. of the end-point. After addition of 15 drops of a saturated 95% EtOH solution of the indicator, the titration is continued to the end-point, canary-yellow to blue-grey, which is sharp. The final vol. of solution should be 65±10 c.c. The indicator blank is 0·07 c.c. of 0·025N-$Hg(NO_3)_2$. For Br′, Roberts' method for Cl′ (A., 1936, 1351) is followed. Agreement with the corresponding Volhard methods is close. Peroxide-free (I) is prepared by distillation from Na, and preserved for ~2 weeks by addition of 0·5 g. of quinol per l. In presence of 10—15% of (I), HgI_2 is pptd. in the yellow form. The method of Dubsky and Trtilek (A., 1934, 744) gave erratic results. L. S. T.

New indicators for iodate–iodine monochloride Andrews analytical procedures. G. F. Smith and C. S. Wilcox (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 49—53).—Naphthol-blue-black (I), B.C.I. No. 246, brilliant-ponceaux 5R (II), B.C.I. No. 185, and amaranth (III), B.C.I. No. 184, are not destroyed by high [HCl] in presence of small amounts of I or ICl, but are rapidly destroyed by a trace of IO_3' under the same conditions. No indicator correction is necessary, and a tendency to fade as the equivalence point is reached is counteracted by delayed addition of the indicator. Determinations with these indicators follow the usual Andrews–Jamieson procedure, except that CCl_4 or $CHCl_3$ is not required. Data obtained by both methods show agreement in determining As^{III}, S_2O_3'' [(III) preferred as indicator], CNS′, SO_3'' [(III) preferred], H_2O_2 [(III) preferred], N_2H_4 [(II) and (III) preferred], and $NHPh{\cdot}NH_2$ [(II) preferred]. For Sb, the new method gives the same results as the $KBrO_3$ method (Bordeaux) (A., 1941, I, 426) and the potentiometric end-point; for Fe, it gives the same results as Heisig's modification (A., 1928, 861) of Andrews' method. In this determination, KIO_3 must be standardised against Fe as low results are obtained if As_2O_3 is used as a standard of reference. With (III), the new method can be used for Fe in presence of org. matter. In the determination of Tl′, the method agrees with the Andrews–Jamieson procedure and the $Ce(SO_4)_2$ potentiometric method of Willard and Young (A., 1930, 312). L. S. T.

Methods of determining fluorides [in water supplies].—See B., 1942, III, 93, 119.

Determination of thiosulphate in presence of sulphite. R. P. Donnelly (*Chem. and Ind.*, 1942, 114; cf. Pankhurst, A., 1942, I, 153).—The procedures of Kurtenacker *et al.* (A., 1925, ii, 239) and Boot and Ward (B., 1935, 535) are recommended. W. McC.

Colour reaction for sulphurous acid etc.—See A., 1942, II, 159.

Use of electrodeless annular discharge in a high-frequency magnetic field in spectrum-analytical detection of traces. E. Fenner (*Spectrochim. Acta*, 1939, **1**, 164—167).—Electrodeless excitation [by a solenoid surrounding the evacuated discharge tube, supplied with a.c. (λ 6 m.) from an oscillator] permits detection of traces of impurity in Sc (*e.g.*, 0·003% of Cd) which are undetected by arc or spark methods. Traces of Se in other materials can be detected similarly. Hg in air is detected at concns. too low to give arc or spark lines. A high-frequency spark method is proposed for poor conductors. A. J. E. W.

Conductometric determination of ammonia. Application to nitrogen distribution studies. R. H. Hendricks, M. D. Thomas, M. Stout, and B. Tolman (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 23—26).—When sintered-glass bubblers and sufficient excess of H_3BO_3 are used, the absorption of NH_3 by H_3BO_3 after vac. distillation or volatilisation by aspiration is satisfactory. BuOH must be used in the absorbent in certain cases. Change in conductance affords an accurate measurement of the amount of NH_3 absorbed. H_2SO_4 is a better absorbent than H_3BO_3 for NH_3, and gives a larger change in conductance; it may be more suitable, particularly in micro-analyses. The method has been applied to N distribution in plant materials, and to automatic analysis of traces of NH_3 in air (data given). Apparatus for absorption is described, and data concerning the stability of NH_4 borate, the vac. distillation of NH_3 at 40—50°, the relation between temp. and alkaline reagent (MgO, NaOH, K_2CO_3, or NaOH–$Na_2B_4O_7$) to time of aspiration, and N distribution in a seed-ball extract are recorded and discussed. L. S. T.

Cheaper Nessler's reagent by use of mercuric oxide. L. F. Wicks (*J. Lab. clin. Med.*, 1941, **27**, 118—122).—Red HgO is used instead of HgI_2 thus: HgO + 4KI + H_2O = K_2HgI_4 + 2KOH. C. J. C. B.

Decomposition of Nessler's solution. W. E. James, F. A. Slesinski, and H. B. Pierce (*J. Lab. clin. Med.*, 1941, **27**, 112).—$COMe_2$ in the air may cause rapid decomp. of Nessler's solution. C. J. C. B.

Determination of hydrazine. Rapid ferricyanide-cerimetric method. C. J. Dernbach [with J. P. Mehlig] (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 58—60).—The N_2H_4 is oxidised by means of aq. NaOH–$K_3Fe(CN)_6$, and the $Fe(CN)_6''''$ produced titrated with 0·1N-$Ce(SO_4)_2$. The procedure consists of adding N_2H_4,H_2SO_4 to an excess of $K_3Fe(CN)_6$, making alkaline with NaOH, shaking for 0·5 min., keeping for 2 min., acidifying with HCl, diluting, and titrating with $Ce(SO_4)_2$, which contains sufficient Fe''' to form colloidal Fe^{III}

ferrocyanide during the titration and gives a green colour. This disappears sharply at the end-point. $FeCl_3$ can be added to provide $Fe^{'''}$ if necessary. The amount of $K_3Fe(CN)_6$ must be carefully controlled, and acidity during the final titration should be $>1{\cdot}8$M. with respect to HCl. Results are reproducible to $<0{\cdot}1\%$, and the titration is simpler than that of the Jamieson iodate method. L. S. T.

Spectrophotometric determination of phosphorus. T. D. Fontaine (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 77—78).—The transmittance–λ curve for the blue colour obtained by the reduction of MoO_4'' in presence of PO_4''' shows a min. at 820 mμ. An improved micro-method, based on earlier procedures and using $SnCl_2$ as reducing agent, is described. The $[SnCl_2]$ can be varied without affecting the intensity of the developed colour, acidity (H_2SO_4) can vary between 1·7 and 2·1N., and the colour is stable for <24 hr. L. S. T.

Acidimetric orthophosphoric acid assay. J. A. Calamari and R. Hubata (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 55—56).—H_3PO_4 in reagent-grade acid, in alkali orthophosphates, in detergents, and in pharmaceutical preps. is determined by titration with 0·5N-HCl from the H_2PO_4' to the HPO_4'' end-point in a solution saturated with NaCl, using cresol-red and bromophenol-blue indicators, respectively, and a colour standard for each of the two end-points. The p_H of the H_2PO_4' and HPO_4'' end-points in saturated NaCl are ~3·15 and 7·65, respectively, at 25°. Org. acids must be removed by charring, CO_3'' by boiling with HCl, SiO_3'' by dehydration (HCl), and meta- and pyro-phosphates converted into orthophosphate by boiling in presence of HCl. Results given by the method agree with those obtained potentiometrically or gravimetrically. L. S. T.

Colorimetric determination of readily soluble phosphate in soils.—See B., 1942, III, 65.

Colorimetric micro-determination of arsenic after evolution as arsine. E. B. Sandell (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 82—83).—The AsH_3 is absorbed in a H_2SO_4 solution of $HgCl_2$ containing $KMnO_4$, which oxidises the As^{III} in one step to AsO_4'''. This is determined by adding an excess of NH_4 molybdate + N_2H_4,H_2SO_4, and heating to obtain Mo-blue. The procedure detailed is designed for 1—15 μg. of As, and a determination takes ~1 hr. to make. Apparatus for the absorption of AsH_3 is described, and test data are recorded. 5—10 μg. of As can be determined with an accuracy of 5%, and 1—2 μg. with one of 10%. Results tend to be low. Small amounts of Sb do not interfere. Acid $KMnO_4$ alone does not absorb AsH_3 completely. $Ce(SO_4)_2$ and $KBrO_3$ cannot replace $KMnO_4$ in the absorbent. AsH_3 is liberated by the A.O.A.C. method. L. S. T.

Micro-determination of arsenic. E. Cahill and L. Walters (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 90—91).—The A.O.A.C. method is modified by replacing cotton wool by glass beads soaked in $Pb(OAc)_2$, and using cotton threads impregnated with $HgBr_2$ by a special method instead of Hanford–Pratt strips of paper. For the determination of 1 μg. of As, thread in glass capillaries gives a more sensitive, more const., and more definite stain than the paper strips. The closer the thread fits the capillary, the more const. is the stain. Data obtained with 1 μg. of As are given. L. S. T.

Determination of silicon in aluminm and its alloys.—See B., 1942, I, 204.

Accurate analysis of gaseous mixtures. C. H. Bamford and R. R. Baldwin (*J.C.S.*, 1942, 26—29).—Apparatus in which confining liquids and absorbents are eliminated is described. Determinations, accurate to 0·03%, depend on pressure measurements after separation of constituents (*e.g.*, CO_2) by cooling or (*e.g.*, hydrocarbons) by oxidation. F. J. G.

Ruthenium dipyridyl, a new oxidimetric indicator. J. Steigman, N. Birnbaum, and S. M. Edmonds (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 30).—Ru dipyridyl enters into a mobile reversible oxidation in which the reduced bivalent form is orange-red and the oxidised tervalent form green in conc. solution. At dilutions comparable with those of indicator solutions, the corresponding colour change is from yellow to colourless on oxidation. Both forms of the new indicator are stable towards acid, and do not dissociate appreciably, even at 100°. The oxidation potential of the indicator is close to that of $Ce^{''''}$ in SO_4'' solution, and the indicator cannot be used satisfactorily with $Ce(SO_4)_2$, but the end-point is sharp with $Ce(NO_3)_4$ in HNO_3. The direct titration of $Na_2C_2O_4$ in 2M-$HClO_4$ at room temp. with $Ce(NO_3)_4$, using two drops of 0·02M-indicator solution per 100 ml., is rapid, precise, and accurate. Agreement to $<0{\cdot}1\%$ was obtained between this titration and standardisation by means of $FeSO_4$ and $Ce(SO_4)_2$ (o-phenanthroline Fe^{II} complex). L. S. T.

Qualitative analysis of the alkali metal group. M. E. Hobbs (*J. Chem. Educ.*, 1941, **18**, 90—91).—Part of the filtrate from the $(NH_4)_2CO_2$ group is boiled with NaOH until NH_3 is expelled completely, and then tested for $K^{'}$ by means of AcOH and $Na_3Co(NO_2)_6$. The other portion is tested for $Na^{'}$ by addition of AcOH and Zn UO_2 acetate (**I**). High $[K^{'}]$ also gives a ppt. with (**I**), and if $K^{'}$ is present most of it is first removed by addition of $HClO_4$. Details of procedure for semi-micro- and macro-analyses are given. L. S. T.

Modified methods for the determination of total alkali, sulphate, nitrate, and phosphate in highly coloured solutions of high organic matter content. N. V. R. Iyengar (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 636—642).—The total alkali, SO_4'', NO_3', and PO_4''' in highly coloured effluents from industrial works can be determined after almost completely decolorising the 'liquid with H_2O_2 and boiling until colourless. Before determining PO_4''' by Denigès' colorimetric method, excess of H_2O_2 must be decomposed by boiling with PO_4'''-free alkali. SO_3'' and NO_2' are oxidised, thus adding to the proportions of SO_4'' and NO_3' already present. C. R. H.

Spectrochemical analysis of alkali products.—See B., 1942, I, 192.

Base-exchange capacity determination in soils by means of a rapid colorimetric method.—See B., 1942, III, 65.

Determination of calcium in lead alloys.—See B., 1942, I, 202.

Determination of radium by a photographic method. H. Meyer (*Brit. J. Radiol.*, 1942, **15**, 85—91).—In the method described three exposures, one with the prep. to be measured and two with a standard prep., are made on the same strip of film. The standard exposures should be ~10% higher and 10% lower than that of the measured prep., thus giving a linear relation between density and exposure. The method is comparatively unaffected by external influences and errors due to variations of emulsion and uneven development of separate films are eliminated. Full details, calculation of results, corrections, and test data are given. N. M. B.

Spectrum-analytical studies on magnesium content of blood in various diseases.—See A., 1942, III, 370.

Determination of lead content of commercial ciders and vinegars by spectrographic methods.—See B., 1942, III, 105.

Polarographic method for determination of lead and zinc in paints.—See B., 1942, II, 114.

Oxanilic acid thioamide as an analytical reagent. A. K. Majumdar (*J. Indian Chem. Soc.*, 1941, **18**, 415—418).—$NHPh{\cdot}CO{\cdot}CS{\cdot}NH_2$ can be used to detect Cu (1 in 75×10^4), Co (1 in 4×10^5), and Ni (1 in 2×10^6) in aq. solution. Cu, Co, and Ni can be determined with an error $>0{\cdot}2\%$. F. R. G.

Quinoline-8-carboxylic acid as an analytical reagent. I. A. K. Majumdar (*J. Indian Chem. Soc.*, 1941, **18**, 419—422).—Quinoline-8-carboxylic acid with a neutral solution of 1 part of Cu in 4×10^6 gives a light blue ppt. $Cu^{''}$ in acid solution is determined as $(C_{10}H_6O_2N)_2Cu$ with an error $>0{\cdot}05\%$ at p_H 7·0. At lower p_H the error is but little greater. Free AcOH prevents complete pptn. F. R. G.

Determination of copper in country spirits.—See B., 1942, III, 78.

Determination of mercury.—See A., 1942, I, 180.

Assay of ointments of mercuric oxide, ammoniated mercury, and mercurous chloride.—See B., 1942, III, 112.

Determination of aluminium in metals and alloys by means of the mercury cathode.—See B., 1942, I, 204.

Rapid determination of aluminium in magnesium alloys by means of 8-hydroxyquinoline.—See B., 1942, I, 204.

Quantitative spectrum analysis of hydronalium alloys.—See B., 1942, I, 204.

Micro-analytical method for the determination of ferrous and ferric iron in minerals. J. Das-Gupta (*J. Indian Chem. Soc.*, 1941, **18**, 375—380).—The mineral is dissolved in HF + HCl in an inert atm. and titrated first with $Ce(SO_4)_2$ and then with $TiCl_3$, using o-$NHPh{\cdot}C_6H_4{\cdot}CO_2H$ acid and KCNS as indicators. F. J. G.

Determination of traces of tin in malt beverages.—See B., 1942, III, 105.

Determination of antimony in lead-antimony alloys.—See B., 1942, I, 202.

Volumetric determination of bismuth as caffeine tetraiodobismuthate. R. S. Beale and G. C. Chandlee (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 43—44).—The sample (~0·03 g. Bi) is dissolved in conc. H_2SO_4, the acidity regulated by evaporation of the acid, dilution, and addition of NaOH, and the Bi pptd. by means of caffeine sulphate solution followed by aq. KI. The washed (Bu_2O) ppt. is decomposed by boiling with NaOH, acidified with HCl, and, after addition of KCN, titrated with aq. KIO_3 to the ICN end-point. The method has been used with 1·2 mg. of Bi, and, with suitable modifications, for the determination of Bi in presence of $Hg^{''}$, $Ca^{''}$, $Sr^{''}$, $Ba^{''}$, $Na^{'}$, $K^{'}$, $Mg^{''}$, $Be^{''}$, $Fe^{'''}$, $UO_2^{''}$, $Al^{'''}$, $Ni^{''}$, $Co^{''}$, $Zn^{''}$, $Mn^{''}$, $Cr^{'''}$, MoO_4'', $As^{'''}$, $Pb^{''}$, $Cd^{''}$, $VO_2^{''''}$, $Sn^{''''}$, $Sn^{''}$, $Sb^{'''}$, AsO_4''', and PO_4'''. $Cu^{''}$, $Ag^{'}$, and $Hg^{'}$ must be absent. Data for determinations in presence of most of these ions are given. L. S. T.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Copper and tellurium group. C. C. Miller (*J.C.S.*, 786—792; cf. A., 1941, I, 175).—Working details are given of a scheme for the detection and approx. determination of 0·25—50 mg. of Bi, Cd, or Cu, 0·25—10 mg. of Mo, Re, Ir, Rh, or Te, and 0·25—2 mg. of Pb in mixtures containing >50 mg. of these metals. The

ppt. containing the metals as sulphides is treated with HCl and H_2O_2, any dark residue being extracted with aqua regia. After evaporation with NaCl, Se and Te are separated as the elements, Te being confirmed with $Ca(H_2PO_2)_2$. In portions of the filtrate Cu is detected as Cu Zn Hg thiocyanate, Bi with $CS(NH_2)_2$, Rh by reduction with $SnCl_2$ and extraction with Bu^nOAc, Ir by oxidation to the blue compound, Re and Mo as complex thiocyanates, Cd with cadion, and Pb with Na rhodizonate. J. W. S.

Spectro-analytical determination of niobium and tantalum in highly alloyed iron and steel samples.—See B., 1942, I, 201.

XI.—APPARATUS ETC.

Low temperature adiabatic calorimeter. Calibration of the platinum resistance thermometers. D. M. Yost, C. S. Garner, D. W. Osborne, T. R. Rubin, and H. Russell, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 3488—3492).—Constructional and operational features are given of (i) an adiabatic low-temp. calorimeter which requires only 2 l. of liquid H_2 for a complete series of C_p measurements from 14° to 90° K., (ii) a calorimeter for measuring v.p. and heats of vaporisation. The calibration of Pt resistance thermometers for the range 14° K. to 200° C. is described. W. R. A.

Electrically-heated funnel heater for small conical funnels. W. C. Tobie (*J. Chem. Educ.*, 1941, **18**, 90—91). L. S. T.

Modifications in the Dumas micro-method for [determination of] nitrogen. Automatic apparatus for combustion micro-methods.—See A., 1942, II, 183.

Infra-red as an analytical tool: dehydration of silicic acid derived from felspars. E. W. Koenig (*Bull. Amer. Ceram. Soc.*, 1941, **20**, 447—450).—The complete recovery of the SiO_2 from the acidified silicate alkali fusion was possible after only one evaporation if the surface of the solution was heated by a 260-w. infra-red lamp at a distance of 1·5 in. This method is also much quicker. The effect may be due to the opacity of quartz to radiation of >7000 A. The method is also recommended for charring filter-papers, cupferron, etc. J. A. S.

Infra-red spectrometer for industrial use.—See B., 1942, I, 179.

Applications of wave-length turbidimetry in the infra-red. C. E. Barnett (*J. Physical Chem.*, 1942, **46**, 69—75).—Opacity caused by reflexion and scattering of light by suspensions of fine particles is discussed with special reference to earlier work of the author (cf. B., 1937, 809) and of Pfund (cf. A., 1934, 130). C. R. H.

Colour measurement. J. W. Perry (*Nature*, 1941, **148**, 691—692).—A discussion concerning standardisation and the need for increased precision in certain colour measurements. L. S. T.

Recording colour of opaque objects. M. E. Stansby and J. A. Dassow (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 13—15).—Colours of opaque objects are compared by preparing photographic colour transparencies, and obtaining spectral distribution curves by means of a photo-electric spectrophotometer. Whenever possible, errors due to variations in illumination during exposure and in processing of the film are eliminated by taking photographs of objects to be compared on the same negative. Application of the method is illustrated by spectral distribution curves for fresh and for stored frozen salmon. L. S. T.

Nature and measurement of whiteness. J. G. Holmes (*Proc. Physical Soc.*, 1942, **54**, 81—86).—The uniqueness of white is discussed from the visual and colorimetric points of view. The sensitivity of the eye to departures from white and the extent of compensation by visual mechanism for changes in illumination are considered. Instrumental methods of colorimetry for whiteness measurement are briefly described. N. M. B.

New Bausch and Lomb refractometer.—See B., 1942, III, 103.

Rapid processing of photographic plates for routine spectrographic analysis. H. B. Vincent and R. A. Sawyer (*Spectrochim. Acta*, 1939, **1**, 131—136).—The apparatus described consists of a mechanical agitator for the processing solutions, a plate washer in which a flat stream of H_2O is projected across the emulsion, and an electric dryer. Details are given of suitable developing, hardening, and fixing solutions. Processing of a spectrogram can be completed in ≯5 min. A. J. E. W.

Line absorption and total absorption of copper resonance lines and determination of radiation temperature in the gas column of the copper arc. H. Schnautz (*Spectrochim. Acta*, 1939, **1**, 173—196).—A form of Cu arc which gives intense resonance lines without self-reversal is described; the emergent light beam is passed through a hole in the anode. The mean temp. of the gas column in a Cu arc at atm. pressure, determined by comparison with the positive crater of a C arc, is 5473±9·3° K.; the temp. increases as the cathode is approached. The variation of the intensity ratio of the 3248 and 3274 A. Cu lines with temp. is examined, and explained qualitatively in terms of simultaneous Doppler and dispersion broadening of the lines; the Doppler effect is particularly strong. The derived variation of total absorption with concn. is anomalous. A. J. E. W.

Dependence of intensity of arc resonance lines of an element on concentration. R. Mannkopff (*Spectrochim. Acta*, 1939, **1**, 197—206).—A comparison of an ordinary Cu arc with an arc free from self-reversal (cf. preceding abstract) shows that the non-linear concn.-dependence of the absorption of spectrum lines is due to self-absorption in the emitting layer, and not to self-reversal in the arc envelope. The anomalous variation of total intensity is ascribed to depletion of atoms within the arc by ionic migration effects; the intensity–concn. curve for the 3130–3131 A. doublet of Be, in which such effects are negligible, is normal. A. J. E. W.

Dropping mercury electrode for lead analyses.—See A., 1942, III, 428.

Preparation of Weston standard cells. W. C. Vosburgh and P. F. Derr (*J. Chem. Educ.*, 1941, **18**, 87—89).—Directions for the prep. of these cells are given, and performance is described. L. S. T.

Glass electrode as a reference electrode in electrometric titrations. L. Lykken and F. D. Tuemmler (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 67—69).—The use of a glass electrode as a reference electrode is recommended for all redox and pptn. titrations that yield potential–vol. curves with realisable inflexion points and that can be carried out between 0° and 50°. Curves for typical titrations are reproduced, and the advantages of the glass over conventional reference electrodes discussed. L. S. T.

Sodium–hydrogen Geissler tube. F. M. Goyan (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 60—61).—Details of construction of a Geissler tube capable of emitting a strong Na *D* line are given. The tube is made of Pyrex glass, and is charged with commercial metallic Na and tank H_2. Under controlled conditions, the *C* and *F* lines of H_2 and the *D* line of Na are emitted simultaneously. The tube operates efficiently as a source of Na line over a wide pressure range, and has a long life. L. S. T.

Electronic relays. S. Redfern (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 64—65).—The circuit described for use with a.c. has a diode beam-power amplifier tube with a separate, independent, rectified grid-bias voltage. L. S. T.

Drift of selenium barrier-layer photo-cell. K. A. Houstoun (*Phil. Mag.*, 1941, [vii], **31**, 498—506).—The current given by an illuminated Se barrier-layer photo-cell decreases with time, and the cell slowly regains its original sensitivity in darkness. The fatigue effect is more pronounced in green than in red light. Exposure to light of one colour reduces the sensitivity of the cell to light of other colours, *e.g.*, when the cell is exhausted for red it is also exhausted for green, irrespective of the colour of the light which produced the exhaustion. L. J. J.

Formula of the selenium barrier-layer photo-cell. R. A. Houstoun (*Phil. Mag.*, 1942, [vii], **33**, 226—237).—The cell is connected to a micro-ammeter and resistance of combined resistance *R* and exposed to *L* ft.-candles illumination. The recorded current *I* is then a function of *L* and *R* and an investigation of the form of this function is reported. Data were obtained for the variation of *I* with *L* and *R* with 5 cells of different origin. Results confirm a formula deduced from consideration of the action of the cell, $1/I = (k/EL) + R(1 + k/rL)/E$, where *r* is the internal resistance and *E* the e.m.f. of the cell. The addition of an empirical term $ae^{-R/b}$ to the right-hand side of the equation is necessary to represent deviation from the straight line. The formula is justified theoretically. N. M. B.

Induction accelerator generating 20 Me.v. D. W. Kerst (*Physical Rev.*, 1942, [ii], **62**, 93—94).—The design follows that of a 2·3-Me.v. accelerator (cf. A., 1941, I, 358), but by means of a pulse of flux generated by auxiliary coils the electrons are caused to spiral outwards to impinge on the W injector structure serving as a target for the production of *X*-rays and for the scattering of primary electrons. N. M. B.

184-in. cyclotron at Berkeley, California. M. L. Oliphant (*Nature*, 1941, **148**, 717).—A brief description, with a photograph, of the apparatus designed to give 100-Me.v. deuterons. L. S. T.

Discharge mechanism of fast Geiger–Müller counters from the dead-time experiment. H. G. Stever (*Physical Rev.*, 1942, [ii], **61**, 38—52).—A simple oscilloscopic method is given for measuring the dead-time (an insensitive time of $\sim 10^{-4}$ sec. between registration of a count and recovery sufficient to register another count). A theory of this dead-time, in good accord with experiment, involves the formation of a positive ion space-charge sheath about the wire of the counter, this sheath expanding to the cylinder. The dead-time experiment shows the internal action of the counter, and also that the discharge spreads throughout the length of the counter but can be stopped by a small glass bead on the wire. N. M. B.

Discharge characteristics of self-quenching counters. W. E. Ramsey and E. L. Hudspeth (*Physical Rev.*, 1942, [ii], **62**, 95—96; cf. A., 1941, I, 439).—Montgomery's counter discharge mechanism for a non-self-quenching gas mixture (cf. A., 1940, I, 306) satis-

factorily explains the dependence of pulse size on counter wire capacity and counter length for the case also of self-quenching gases. Data and curves for the dependence are given and the essential difference between the two types of counter is illustrated and discussed. N. M. B.

Directional properties of self-quenching counters. W. E. Ramsey (*Physical Rev.*, 1942, [ii], **62**, 96—97).—Stever's method of producing directional properties by means of glass beads on the counter wire is discussed (cf. A., 1941, I, 349). In a self-quenching mixture the entire ionisation process is confined to the vicinity of the wire and spreads along it from a starting point initiated by the ionising ray. Hence the discharge may be confined to any desired section of the counter by any procedure which interferes with this step-by-step process of propagation. The procedure of reducing the electric field at points where it is desired to interrupt the discharge, using a segmented counter (cf. A., 1940, I, 424), is described and discussed. Particles may thus be counted and their ionising capacity simultaneously measured within the same counter. N. M. B.

Counter as a measuring instrument. W. Kolhörster and E. Weber (*Physikal. Z.*, 1941, **42**, 13—19).—Types of counter and auxiliary apparatus (amplifiers, boosters, counting devices, and coincidence mixing circuits) suitable for reliable continuous recording of cosmic rays are reviewed and discussed. A. J. E. W.

Helium-filled Geiger–Müller counters. P. L. Kapur, H. R. Sarna, and Charanjit (*Current Sci.*, 1941, **10**, 521—522).—The characteristics of counters filled with mixtures of He with the vapours of various alcohols at different partial pressures have been investigated. Curves for no. of counts against the potential of the wire of the counter are given for He mixed with MeOH, EtOH, Pr$^{\beta}$OH, and Et_2O. There is at first a rapid rise, followed by a plateau, and then a further rise. The plateau is longest for He–MeOH, where it extends over 400 v. He–EtOH is also good, but the threshold potential is higher. The threshold potential increases with increasing concn. of org. vapour. This may be due to the fact that the greater amounts of org. vapour decrease the effective mean free path for ions by increasing their size considerably, by condensation or formation of clusters. This makes it necessary to use larger fields to produce ionisation by collision, and thus to start a discharge. The threshold potentials are lower for counters filled with He–MeOH than for those with A–MeOH. A. J. M.

Simpler weighing. G. W. Harris (*J. Chem. Educ.*, 1941, **18**, 81—82).—The single deflexion method is recommended. L. S. T.

Recording automatic balance. P. Ewald (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 66—67).—The instrument described is suitable for investigations of rock phosphate sedimentation, dehydration, hygroscopicity, rapid corrosion, and changes in ρ. L. S. T.

Tapless micro-burette with a stock bottle and its application to old and new analytical methods. I. Lütgert and E. Schröer (*Z. physikal. Chem.*, 1941, **B**, **49**, 257—270).—The apparatus is described, and its use in the usual volumetric processes is outlined. The % errors in these processes are evaluated. The micro-burette gives results equal in accuracy to those obtained by macro-methods. A. J. M.

Automatic quadruple pipetting machine for rapid and accurate delivery of measured small amounts of fluid. R. J. Lebowich, H. D. Gursky, C. F. Ackerbauer, and F. A. Opps (*J. Lab. clin. Med.*, 1941, **27**, 244—247). C. J. C. B.

Attachment for pipettes for precise transfer of dangerous fluids. W. R. Thompson (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 73).—The apparatus described and illustrated has been used for dangerous reagents, and for precise work with bacterial and virus suspensions. L. S. T.

Du Pont type semi-micro-nitrometer. P. J. Elving and W. R. McElroy (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 84—88).—Construction and operation of two types of nitrometer, one hand- and the other motor-shaken, are described. Various inorg. and org. nitrates, including those of cellulose, have been analysed by means of this apparatus, which can be applied with economy of time and Hg to other determinations for which the Lunge nitrometer is used. Precision and accuracy are slightly < those obtainable on the macro-scale. L. S. T.

Simple gas-testing appliance.—See B., 1942, I, 179.

Instrumental methods of chemical analysis. R. H. Müller (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 667—754; cf. A., 1941, I, 59).—An illustrated review of instrumental methods relating to ρ, gas analysis, spectroscopic analysis, colorimetry, fluorescence, refractometric methods of analysis, polarimetry, potentiometric and conductometric analyses, the polarograph, electrographic methods of analysis, ϵ, radiometric and mass spectrographic methods. L. S. T.

Apparatus for photo-electric titrations. H. N. Alyea (*J. Chem. Educ.*, 1941, **18**, 57). L. S. T.

Nomenclature of optical processes in colorimetric analyses. R. Havemann (*Z. physikal. Chem.*, 1941, **A**, **188**, 182—190).—A discussion on the correct use of the terms "absolute colorimetry" and "spectrophotometry." F. J. G.

Dithizone method for determination of lead: mechanical shaker for separatory funnels. L. R. Crisp and S. H. Webster (*J. Lab. clin. Med.*, 1941, **27**, 269—270). C. J. C. B.

Inexpensive specific gravity apparatus. H. L. Motley (*J. Lab. clin. Med.*, 1941, **26**, 1959—1961). C. J. C. B.

Tube for centrifuging 16 specimens in a 4-place centrifuge. E. E. Holmes (*J. Lab. clin. Med.*, 1941, **27**, 252—253).—7 10-mm. centrifuge tubes are packed into each 50-c.c. brass cup supplied with the centrifuge. C. J. C. B.

Immersion still-head for low-pressure distillation of organic mixtures. A. J. Bailey (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 71).—The still-head described has been used successfully with mixtures characterised by high b.p., viscous or tarry consistency, and a marked tendency to bump, froth, or spatter. Still-heads of this type fill the gap between vac. and mol. distillation. L. S. T.

Improved distilling column head. A. Turk and A. Matuszak (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 72).—The column head described for total reflux-variable take-off distillation has been used on ~30 columns of various types with compounds boiling from 36° to 168°. L. S. T.

Laboratory flowmeter with interchangeable precision-bore capillaries. F. C. Croxton (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 69—70). —Details of construction and performance are given. L. S. T.

Applications of determinants. A. Alison (*Ind. Chem.*, 1941, **17**, 156—161).—The application of determinants to elimination, solution of equations, and nomography is illustrated. L. J. J.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Lecture experiments in general chemistry. VI. Liquefaction and fractionation of air. VII. Liquefaction and fractionation of natural gas. S. Morris and A. J. W. Headlee (*J. Chem. Educ.*, 1941, **18**, 79—80). L. S. T.

John Mayow, 1641—79. D. McKie (*Nature*, 1941, **148**, 728).—Evidence that Mayow was born in Cornwall in December, 1641, is presented. L. S. T.

John Mercer. H. Rheinboldt (*J. Chem. Educ.*, 1941, **18**, 80). L. S. T.

V. V. Markovnikov. H. M. Leicester (*J. Chem. Educ.*, 1941, **18**, 53—57). L. S. T.

XIII.—GEOCHEMISTRY.

Spectroscopic studies of base exchange materials.—See A., 1942, I, 124.

Experimental flow of rocks under conditions favouring recrystallisation. D. Griggs (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1001—1022; cf. A., 1939, I, 110).—Pressure alone changes the behaviour of rocks and simulates some types of natural deformation, but it is inadequate to explain all natural flow because of the large increase in rock strength involved, its inability to produce plastic behaviour in quartz (I), and the development of too intense mechanical twinning in calcite aggregates. Preliminary experiments at high pressure indicate that temp. alone produces unimportant effects on the deformation of rocks. Creep tests show that the flow of Solenhofen limestone loaded to 1400 kg. per sq. cm. is so slow that deformation would be negligible in $>10^6$ years. When conditions are such that dissolution and recrystallisation may occur, the observed characteristics of rock flow are quite different. At high temp. and in presence of solutions, (I) appears to show recrystallisation flow; the flow of marble is also altered. Creep tests on Ohio alabaster, which shows little deformation when dry, indicate relatively rapid flow in presence of solutions. The rate of flow increases exponentially with stress. The important rôle that dissolution and recrystallisation may play in rock deformation is emphasised. L. S. T.

Cosmical abundance of the elements.—See A., 1942, I, 125.

Sedimentary basins of Ontario. Possible sources of oil and gas. A. E. Wilson, J. S. Stewart, and J. F. Caley (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 167—185).—Information concerning the numerous attempts to find oil and gas is summarised, and related to the Palæozoic basins, as basins. The Delaware–Onondaga strata of the Ontario peninsula provide the greatest oil-producing formation in Ontario. Devonian rocks in the Hudson Bay area have yielded no oil. Oil occurs in small quantities in the Guelph dolomite and in the Whirlpool sandstone at the base of the Silurian; otherwise, it does not occur in the Silurian of Ontario. Gas is produced in large quantities from the Silurian rocks in the Niagara peninsula region. Commercial amounts of oil are found in rocks of Trenton age only in Dover West in the Ontario peninsula. Gas occurs at two levels in the Ordovician, in rocks of Gloucester and Trenton ages. Gas is reported from wells in the black shales of Central and Eastern Ontario. No oil or gas has been reported from the Ordovician strata in the Hudson Bay area. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JUNE, 1942.

I.—SUB-ATOMICS.

General physical constants. R. T. Birge (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 90—134).—A progress report, to August, 1941, with details on the velocity of light only. W. J.

M.I.T. wave-length project. G. R. Harrison (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 212—230).—A progress report. W. J.

Simple formula for wave-length measurement in ultra-violet spectra. P. Bary (*Compt. rend.*, 1941, **213**, 165—166).—A formula, which gives good vals. for 13 lines of Hg, is proposed for the reduction of wave-lengths from measurements in quartz-prism spectrograms. W. R. A.

Precision method for the measurement of the wave-lengths of diffuse lines. W. W. A. Johnson and D. Norman (*J. Opt. Soc. Amer.*, 1941, **31**, 177—178).—A method is described of determining in the micrometer trace of a diffuse, asymmetric, self-reversed line (*e.g.*, Sn 3330, 3262, and 3175 A.) the centre of intensity of the line, *i.e.*, the vertical line which divides the spectral line into areas of equal intensity. This is the most significant measure of the position of a line. O. D. S.

Electrode concentrations and total intensity of spectral lines. H. Hemmendinger (*J. Opt. Soc. Amer.*, 1941, **31**, 150—156).—The intensities of the Fe and Ti lines in a d.c. arc between Fe or Fe–Ti (Ti 30—99%) electrodes have been measured and compared with theoretical vals. For Fe electrodes the intensity ratios agree with theoretical at low c.d. At high c.d. the intensity of the strongest lines is below the theoretical, and lines of low excitation potential deviate > those of high excitation potential. A similar change with increasing concn. of either element in the mixed electrodes is observed at low c.d. As the concn. of Fe is increased the intensity of the strongest lines begins to fall below the theoretical. A similar effect is observed for Ti but does not show the same dependence of deviation on the excitation potential of the lines as was observed for Fe. This indicates that the weakening of the strongest Ti lines is due to self-absorption rather than self-reversal. The best criterion for the determination of concn. ratio from observed intensities is obtained by plotting the observed against theoretical intensities for a large no. of lines of both elements and measuring the ratio of intensity for that part of the curve which is a straight line. The dependence of this ratio on the abundance ratio from 0 to 100% of Fe in Fe–Ti mixtures is given. O. D. S.

Spectrochemical analysis by the stepped sector method.—See A., 1942, I, 181.

Spectrum-analytical determination of metals in microscopical preparations.—See A., 1942, I, 181.

Use of electrodeless annular discharge in a high-frequency magnetic field in spectrum-analytical detection of traces.—See A., 1942, I, 182.

He I lines in Balmer continuum. F. E. Roach and L. Blitzer (*Astrophys. J.*, 1940, **92**, 50—58).—Equiv. widths of He I lines of diffuse series, measured for 22 stars of classes Oe 5 to B 5, show that higher members of the triplet diffuse series are abnormally weak. This weakening is interpreted in terms of an increase in the continuous absorption coeff. in the Balmer continuum. Comparison with theory suggests a high H content for these stars. E. R. R.

Zeeman effect and the nature of some new helium lines. P. Jacquinot (*Compt. rend.*, 1941, **213**, 64—67).—The nature of He lines of the types ^3P—^3D, ^1P—^3F, ^1P—^1F, ^3P—$^{3,1}F$, and ^3P—G, has been investigated by studying the Zeeman effect. The lines are very weak, and are in the neighbourhood of much more intense lines, thus making the study of the Zeeman effect difficult. All the transitions studied start from the ^3F level. The Zeeman splittings are those which would be given by quadrupole lines. Owing to the fact that the ^3F level is the superposition of three levels $^3F_2$, $^3F_3$, and $^3F_4$, these three levels suffer a complete Paschen–Back effect. By combining the rules for this effect for dipole lines, and those of the Zeeman effect for quadrupole lines, it is shown that the complete Paschen–Back effect for the lines of the multiplet is the same as the Zeeman effect of the singlet lines, for a quadrupole line. The lines due to the transitions $^3P_{1,2}$—^3F and ^1P—^3F are considered to be of this type. A. J. M.

Remarkable [auroral] green-line source. J. Kaplan (*Nature*, 1942, **149**, 273).—A tube previously used (A., 1940, I, 275) when cleaned and filled with N_2 at 100 mm. quickly developed a strong afterglow rich in the green auroral line. Another tube at 50 mm. also showed strong forbidden O and N line excitations. Apparently the catalytic effect of the walls for the destruction of active N had been removed. A. A. E.

Kinetic temperature of the solar reversing layer. P. J. Rubenstein (*Astrophys. J.*, 1940, **92**, 114—117).—Redetermination of the curve of growth for the sun gives 5400°±1300° as the temp. of the solar reversing layer for Fe atoms, and $1{\cdot}7 \times 10^{-6} \pm 0{\cdot}40 \times 10^{-6}$ as the damping const. E. R. R.

Emission spectra of the rare-earth elements. W. F. Meggers (*J. Opt. Soc. Amer.*, 1941, **31**, 157—159).—A review of present knowledge of the analysis of the emission spectra of the rare-earth elements. 5000 Tin lines have been measured between 2200 and 9000 A., and a partial analysis of the spectrum is reported but not described in detail. O. D. S.

Transition probabilities of forbidden lines. S. Pasternack (*Astrophys. J.*, 1940, **92**, 129—155).—The calculation of transition probabilities of forbidden lines for atoms in p^2, p^3, p^4, d^2, and d^3 configurations is discussed. Results for many elements in p^k configurations, for the d^2 configuration of Fe VII, and for the d^3 configuration of C VI, Mn V, and Fe VI are given. E. R. R.

***DO* Aquilae 1925—an unusual nova of Nova Pictoris 1925 type.** B. Vorontsov-Velyaminov (*Astrophys. J.*, 1940, **92**, 283—288).—In its decline the nova showed strong lines of [Fe II]. Its light curve is similar to that of Nova Pictoris, and the comparison leads to reconstruction of unobserved parts of both curves. E. R. R.

Spectrum of NGC 6543 and its nucleus. P. Swings (*Astrophys. J.*, 1940, **92**, 289—294).—Bowen's fluorescence mechanism is absent; the recombination process is especially efficient in the nebula, giving strong lines of C II, C III, and N III. The nucleus is a Wolf–Rayet star showing lines of N IV and C IV of similar intensities, and is thus intermediate between *WN* and *WC* sequences. E. R. R.

Nebular spectra of two slow novæ *DQ* Herculis and *RT* Serpentis. P. Swings and O. Struve (*Astrophys. J.*, 1940, **92**, 295—302).—In Nova Herculis many new lines are identified in the region 3200—6700 A. The spectrum has not changed much since 1935—6 but the increased separation of the two visible components now makes it possible to observe their spectra separately. They exhibit similar ionisations but some differences of line structure. In Nova Serpentis lines of [Ne III], [Ne V], [Fe VI], H, He I, He II, and [O III] are strong, but those of [Fe III] are very weak; the spectrum has thus changed markedly since 1931. E. R. R.

Physical processes in gaseous nebulæ. X. Collisional excitation of nebulium. M. H. Hebb and D. H. Menzel (*Astrophys. J.*, 1940, **92**, 408—423).—Calc. target areas for collisional excitation of O III by electron impact are large, especially for excitation between the levels of ^3P. In nebulæ the levels of $^3P_2$ and atoms in the ground level attain a high population, which is consistent with resonance absorption of He II λ 303 by the coincident line $^3P_2$—$^3P_2$ of O III as proposed by Bowen. E. R. R.

γ-Cassiopeiæ. R. B. Baldwin (*Astrophys. J.*, 1940, **92**, 82—113).—Equiv. widths of sharp absorption lines of He and H are measured, and the distance from the photosphere to the stratum in which the lines are produced is derived. Results are consistent with the radii determined from broad absorption and emission lines. The sharp absorption lines are produced in the outermost layers. Variations in the emission intensity ratios of the two components of the lines of ten elements are established and discussed. E. R. R.

Absorption spectrum of γ-Cassiopeiæ in 1940. M. L. Tcheng (*Compt. rend.*, 1941, **213**, 162—164).—Absorption and emission (bright-line) spectra are compared. The presence of lines, due to H I, Ca II, Mg II, Fe II, C II, Fe III, He I, He II, N II, O II, and Al III, in the absorption spectrum is reported. W. R. A.

Alternations in stability of compounds of the elements of group V. J. H. Hildebrand (*J. Chem. Educ.*, 1941, **18**, 291—292).—Cor-

relations between ionising potential and the stability of the chlorides and oxides of the fifth group of the periodic system are discussed. L. S. T.

Discharge phenomena in gases. R. W. Lunt, A. von Engel, and J. M. Meek (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 338—367).—A progress report. W. J.

High-frequency conductivity and effective dielectric constant of electronic medium in a high-vacuum thermionic valve. R. G. Basak (*Indian J. Physics*, 1941, **15**, 343—358).—The high-frequency conductivity of the anode–screen-grid space in a thermionic valve is $\propto$ the thermionic current, and increases with frequency and with the time of stay of electrons. The effective dielectric const. of the electronic medium decreases rapidly with increase in the transit time of electrons. W. R. A.

Relation between the magnitudes of the first and of the total electron affinity of atomic residues. B. V. Nekrassov (*J. Gen. Chem. Russ.*, 1941, **11**, 669—670).—The energy E_1 of the reactions $F^{7+} \rightarrow F^{6+}$, $Cl^{7+} \rightarrow Cl^{6+}$, $O^{6+} \rightarrow O^{5+}$, and $S^{6+} \rightarrow S^{5+}$ and that, E_2, of the reactions $F^{7+} \rightarrow F^-$, $Cl^{7+} \rightarrow Cl^-$, $O^{6+} \rightarrow O^{--}$, and $S^{7+} \rightarrow S^{--}$ are related by the expression $E_2 = (0{\cdot}507 \pm 0{\cdot}002)zE_1$, z being 7 for F and Cl and 6 for O and S. This equation appears to have a theoretical significance. J. J. B.

Gram electron. L. F. Audrieth and M. J. Copley (*J. Chem. Educ.*, 1941, **18**, 373—374).—The use of the concept of the gram electron, mass $9 \times 10^{-28} \times N$ g., is advocated. L. S. T.

Separation and use of stable isotopes. H. C. Urey (*J. Appl. Physics*, 1941, **12**, 270—277).—The Hertz diffusion, the Clusius and Dickel thermal diffusion, and the distillation and chemical exchange methods of separating stable isotopes are described. The production, cost, time required to establish equilibrium, and probable ease of enlargement of the apparatus to greater capacity are compared for these methods. The use of stable isotopes of H, C, O, and N in the investigation of chemical and biological problems is discussed and it is suggested that these may prove at least as useful as radioactive indicators. O. D. S.

γ-Radiation of radio-thorium. J. Surugue and S. T. Tsien (*Compt. rend.*, 1941, **213**, 172—174).—The radiation accompanying the emission of α-particles from radiothorium is γ-radiation and not, as suggested by Meitner (*Z. Physik*, 1928, **52**, 637), X-radiation. The energies of the two γ-radiations emitted are 86·8 and 83·3 ke.v. W. R. A.

Scattering of neutrons in deuterium. C. K. Sundarachar and J. F. Streib (*Nature*, 1942, **149**, 51).—Using neutrons released in the Be–D nuclear reaction, the scattering of medium-fast neutrons in D_2 has been investigated. The curve relating no. of tracks with energy of recoil deuteron shows max. at 1·2 Me.v. (which may correspond with the peak energy of the low-energy group of neutrons) and, more prominently, at 0·7 Me.v. The latter is presumably due to an anomaly in the neutron–deuteron interaction; it may be associated with the Ramsauer effect and with Bethe's $\lambda_{cr} = 5{\cdot}4 \times 10^{-13}$ cm. There is a wide spread of energy in the neutron beam which is scattered in the gas contained in the ionisation chamber. A. A. E.

Cloud-chamber analysis of barytron secondaries. J. I. Hopkins, W. M. Nielsen, and L. W. Nordheim (*Physical Rev.*, 1939, [ii], **55**, 233).—Secondaries produced by barytrons (filtered through 274 g. per sq. cm. of Fe) in a 0·82-cm. Pb plate or three spaced 0·31-cm. Pb plates have been studied in a counter-controlled cloud-chamber. The no. of single secondaries is not significantly greater in a 0·82-cm. than in a 0·31-cm. Pb plate. Nearly all the observed secondaries can be explained by assuming that they are produced by direct collisions between barytrons and at. electrons. A. J. E. W.

Significance of sidereal time variations of cosmic rays. A. H. Compton and P. S. Gill (*Physical Rev.*, 1939, [ii], **55**, 233).—Analysis of all available data by Fourier and harmonic-dial methods indicates an amplitude of the sidereal time variation which is $\ll$ that predicted by Compton and Getting's galactic rotation theory. Application of a new harmonic-dial method to data from Mexico and the Pacific shows the probable insignificance of the first harmonic present in the Fourier series, and the existence of a real second harmonic corresponding with a 12-hr. sidereal period. The results indicate that the earth is not moving appreciably with respect to the cosmic-ray source, and hence that the rays do not come directly from outside our galaxy. A. J. E. W.

Direct demonstration of spontaneous meson disintegration. P. Auger, R. Maze, and R. Chaminade (*Compt. rend.*, 1941, **213**, 381—383).—A beam of penetrating cosmic rays traverses a system of two parallel superposed horizontal counters separated by a 10-cm. Pb filter. Coincidences denote the passage of each meson. Below the second counter is a layer of several cm. of Pb in which ~1% of the mesons is retarded and undergoes disintegration, emitting a neutrino and an electron. These electrons emerge from the Pb and a fraction of them are recorded by a third counter at a time subsequent to the original coincidence (cf. Rasetti, A., 1941, I, 316). N. M. B.

Photographic method of estimating the mass of the mesotron. D. M. Bose and (Miss) B. Choudhuri (*Nature*, 1942, **149**, 302).—After applying to the results previously obtained (A., 1941, I, 396) corrections relating, respectively, to the val. of Z and to the grouping of the lengths of the ionisation tracks, the mesotron mass is recalc. as $217 \pm 30m_0$. Curvatures of the pair tracks lead to the val. $186{\cdot}0m_0$. A. A. E.

Applied nuclear physics. R. D. Evans (*J. Appl. Physics*, 1941, **12**, 260—269).—A review of the applications of methods derived from nuclear physics in chemistry, metallurgy, radiology, geology, physiology, and medicine. The uses of "tracer" atoms in chemistry, metallurgy, and physiology are described. O. D. S.

Symmetry properties of nuclear levels. E. P. Wigner and E. Feenberg (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 274—317).—A progress report. W. J.

Lorentz invariance in quantum theory. (Sir) A. Eddington (*Proc. Camb. Phil. Soc.*, 1939, **35**, 186—194).—Attention is drawn to the frequent disregard in quantum theory investigations of the proviso that the co-ordinates to which the formal conditions of Lorentz invariance apply form a 4-vector, and special attention is directed to the misapplication of Lorentz invariance in Dirac's theory of the H atom and in the calculation of degeneracy energy of ionised material. W. J.

Lorentz invariance in the quantum theory. (A) P. A. M. Dirac, R. Peierls, and M. H. L. Pryce. (B) (Sir) A. Eddington (*Proc. Camb. Phil. Soc.*, 1942, **38**, 193—200, 201—209).—(A) A reply to criticism by Eddington (see preceding abstract).
(B) Further criticism. L. J. J.

Lorentz invariance of the Dirac theory of the positron. H. Hönl (*Physikal. Z.*, 1941, **42**, 294—295).—Further points in elaboration of previous work are discussed (see A., 1942, I, 163). A. J. M.

Opacity of gas mixtures in stellar systems. P. M. Morse (*Astrophys. J.*, 1940, **92**, 27—49).—Opacities of mixtures of H_2, He, O_2, Na, Mg, Si, K, Ca, and Fe are computed, for any proportions of H_2 and He and for 4 mixtures of the heavier elements, for temp. $4 \times 10^{4°}$ to $10^{9°}$, and for densities from 10^{-2} to 10^4 g. per c.c. The dependence of the opacity on the chemical constitution of the mixture and the bearing of these results on the computation of [H] in stars are discussed. E. R. R.

Nuclear reactions in the carbon cycle. H. A. Bethe (*Astrophys. J.*, 1940, **92**, 118—121).—The life-times of ^{12}C and ^{14}N previously assumed to be in the ratio of ~1 : 20 are approx. equal, viz., $2{\cdot}5 \times 10^6$ and 4×10^6 years respectively. In main-sequence stars the abundances of ^{12}C and ^{14}N should be approx. equal and the combined abundance of C and N should be ~1% by wt., a result in closer agreement between observations and the requirements of the C cycle. E. R. R.

Internal temperature of white dwarf stars. R. E. Marshak (*Astrophys. J.*, 1940, **92**, 321—353).—The state of matter, temp. distribution, and electron density in the interior of a white dwarf arc investigated. The central temp. and radii of Sirius B ($\theta_c = 1{\cdot}5 \times 10^{7°}$ c.) and 40 Eridani B ($\theta_c = 3 \times 10^{7°}$ c.) are difficult to reconcile with the thermonuclear reactions of the C cycle. At such temp. and the prevailing high densities reactions between protons and other nuclei would be very rapid. It is concluded that no H is present, and that the energy production is due to gravitational contraction rather than thermonuclear reactions. E. R. R.

II.—MOLECULAR STRUCTURE.

Applications of spectroscopy to combustion. A. G. Gaydon (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 50—70).—A progress report. W. J.

Molecular electronic spectra, dispersion, and polarisation. Theoretical interpretation and computation of oscillator strengths and intensities. R. S. Mulliken and (Mrs.) C. A. Rieke (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 231—273).—A progress report. W. J.

Chemistry of high-current carbon arc. W. Finkelnburg (*Z. physikal. Chem.*, 1941, **B**, **49**, 297—302).—The characteristics of the high-current C arc are described, and problems awaiting solution, especially those connected with the spectrum of the arc, are pointed out. A. J. M.

Temperatures in spectroscopic sources used in analytical work. O. S. Duffendack and J. M. La Rue (*J. Opt. Soc. Amer.*, 1941, **31**, 146—149).—The temp. parameters T of the d.c. and a.c. arcs between graphite electrodes and in the a.c. arc between graphite electrodes coated with NaOH have been determined from measurements of the distribution of intensity among the rotational lines o the CN band at 4216 A. T is equal to the temp. of the source only when thermal equilibrium is attained; for other sources it is an equiv. temp. and, by substitution in the Boltzmann formula, determines the populations of at. levels of different excitation. T is found to be independent of the arc current and the length of the gap and is

not correlated with the temp. of the electrodes observed visually. Average vals. of T for the high-voltage a.c. arc and the d.c. arc between graphite electrodes are respectively 8616° and 7136° K. The presence of NaOH on the electrodes does not reduce T of the high-voltage a.c. arc. O. D. S.

Spectra of comet heads. V. Dufay (*Compt. rend.*, 1941, **213**, 160—162).—A no. of band-lines in the spectra of comet heads, particularly in the region 3930—4140 A., are attributed to NaH. W. R. A.

Possible existence of formaldehyde in the atmosphere of Venus. R. Wildt (*Astrophys. J.*, 1940, **92**, 247—255).—No absorption bands of CH_2O are detected in ultra-violet spectrograms of Venus. Their absence does not preclude photochemical formation of CH_2O in the planet's atm. in the past. Solid polyoxymethylene hydrates may constitute the clouds observed in the atm. E. R. R.

Vibrational spectra of hydrocarbon molecules. IV. General method of forming equations for computation of the vibrations of complicated molecules. M. A. Eliaschevitsch (*J. Phys. Chem. Russ.*, 1940, **14**, 1381—1395; cf. A., 1941, I, 192).—If different vibrations in a mol. are mutually independent their equations can be found as soon as the symmetry of the mol. is known. Examples are worked out for a non-linear mol. XY_2, a tetrahedral mol. XY_4, and a plane symmetrical mol. X_2Y_6. J. J. B.

Identification of homologous organic compounds or isomerides by their near infra-red absorption spectra. (Mme.) M. Freymann and R. Freymann (*Compt. rend.*, 1941, **213**, 174—177).—Aliphatic hydrocarbons absorb near 1 μ. The band, $4\nu(CH) + \delta(CH)$, has two max. at ~1·02 and 1·04 μ. The difference in intensity, Δh, of these varies with the no. of C in the hydrocarbons in a regular manner, the component at 1·02 μ. becoming more intense as the no. of C increases. The greater is the branching in isomerides the lower is the intensity of the 1·02 μ. component. Ketones give similar results. W. R. A.

Infra-red absorption spectra of ethylene and tetradeuteroethylene under high resolution. W. S. Gallaway and E. F. Barker (*J. Chem. Physics*, 1942, **10**, 88—97).—Several infra-red bands of C_2H_4 and C_2D_4 have been resolved, and from the rotational consts. vals. of moments of inertia, and mol. dimensions have been calc.: C—C 1·353, C—H 1·071 A., angle H–C–H 119° 55′. Fundamental frequencies consistent with observed data have been assigned. W. R. A.

Systematics in the vibrational spectra of the halogen derivatives of methane. T. Y. Wu (*J. Chem. Physics*, 1942, **10**, 116—124).—From considerations of mol. symmetry and the approx. nature of the vibrations, observed infra-red and Raman frequencies of halogen derivatives of CH_4 have been classified, and transitions in passing along the series CH_4, MeX, CH_2XY, CH_2X_2, CHX_2Y, CHX_3, CX_4 (X and Y = halogen) are indicated. A valency-force treatment of CH_2X_2 mols. is given. The potential function contains six consts. and $\nu\nu$ equations have been derived. W. R. A.

Low-frequency fundamental band of ethane at 12 μ. R. G. Owens and E. F. Barker (*J. Chem. Physics*, 1942, **10**, 146).—Re-examination of the 12 μ. band of C_2H_6 indicates that (i) the spin effect is operative and accentuates slightly every third line, (ii) the band centre lies at 820·82 cm.$^{-1}$ and the high-frequency side is the more intense, (iii) approx. midway between the major peaks a series of minor absorption max. are observed, arising probably from the change $1 \rightarrow 2$ in the same vibrational quantum no. for which the transition $0 \rightarrow 1$ yields the principal band. W. R. A.

Molecular vibrations and infra-red spectrum of acetaldehyde. H. W. Thompson and G. P. Harris (*Trans. Faraday Soc.*, 1942, **38**, 37—46).—The infra-red spectrum of MeCHO vapour has been measured in the range 1—20 μ., and 14 fundamental frequencies are assigned on the basis of these results and of Raman data; that corresponding with the torsional oscillation about the C–C bond is missing. The difference (2—3 g.-cal.) between the observed sp. heat and that calc. from the 14 fundamentals suggests a considerable barrier to internal torsion. F. L. U.

Absorption of polysubstituted benzene derivatives. A. L. Sklar (*J. Chem. Physics*, 1942, **10**, 135—144).—The intensification of the forbidden $^1A_{1g} \rightarrow {}^1B_{2u}$ transition in C_6H_6 by non-chromophoric substituents is due to the unsymmetrical distortion of the ring by the normal vibrations and to the transition moment produced at the equilibrium position by the migration of charge from the substituent into the ring, or vice versa. These effects are discussed mathematically and predicted ratios of intensification agree well with experimental data. W. R. A.

OH band in the infra-red absorption spectra of organic molecules. (Mlle.) A. M. Vergnoux and (Mlle.) R. Dadillon (*Compt. rend.*, 1941, **213**, 166—169).—The spectra of C_6H_6, PhOH, *o*-$OH{\cdot}C_6H_4{\cdot}CHO$ (I), EtCHO, PhCHO, and *o*-$C_6H_4Cl{\cdot}OH$ (II) have been examined from 2·6 to 3·2 μ. The C_6H_6 nucleus gives bands at 3439, 3390, and 3312 cm.$^{-1}$; PhOH gives a narrow OH band at 3638 cm.$^{-1}$ in dil. solution in CCl_4 and a broad OH band at 3390 cm.$^{-1}$ in conc. solution. (I) gives a band at 3358 cm.$^{-1}$ in dil. solution which fuses into a much wider band in conc. solution. Dil. solutions of (II) give two bands at 3600 and 3530 cm.$^{-1}$ For equimol. concn. general absorption near 3500 cm.$^{-1}$ is in the following order: (I) > (II) > PhOH > PhCHO > C_6H_6. The significance of the positions of bands and of differences in intensities is discussed. W. R. A.

Light absorption and constitution of organic compounds. I. Analysis of the extinction curves of aromatic Schiff's bases. A. von Kiss and G. Auer (*Z. physikal. Chem.*, 1941, **A**, **189**, 344—363).—The extinction curves of several aromatic aldehydes and amines and of the Schiff's bases derived from them have been measured over the ν range 20,000—46,000 cm.$^{-1}$ In the absorption spectra of Schiff's bases the characteristic bands of the parent aldehyde and amine are usually absent. With increasing no. of conjugated double linkings the energy of excitation is decreased, so the C_6H_6 bands are shifted towards longer λ and the intensity of the bands is increased. The formation of H bonds and quinonoid structures causes the appearance of a new band near the limit of the visible region. The mechanism of the absorption is discussed. J. W. S.

Light absorption of cobalt thiosulphate solutions. A. von Kiss and E. Major (*Z. physikal. Chem.*, 1941, **A**, **189**, 364—372).—The extinction curves of various conc. solutions of $CoSO_4$ and CoS_2O_6 and of $CoSO_4$ in various conc. solutions of $Na_2S_2O_3$, H_2SO_4, and $Na_2S_2O_6$ have been measured at room temp. and over the λ range 2000—7000 A., in comparison with the extinction curve of $Co(ClO_4)_2$, attributable to the $Co(H_2O)_6^{\cdot\cdot}$ ion. Evidence is obtained that in the presence of excess of $Co^{\cdot\cdot}$ and S_2O_3'' ions, CoS_2O_3 and the co-ordination complex $Co(S_2O_3)_2''$ are formed. In conc. H_2SO_4 a complex $Co(SO_4)_2''$ is formed. Owing to the low solubility of $Na_2S_2O_6$ the formation of $Co(S_2O_6)_2''$ could not be established. The mechanism of the absorption is discussed. J. W. S.

Structure and absorption of hydroxylic dyes derived from triphenylmethane. Tautomerism of the benzaurins and phthaleins. (Mme.) P. Ramart-Lucas (*Compt. rend.*, 1941, **213**, 67—69).—The absorption spectra of benzaurin, tetrabromobenzaurin, and the ester of tetrabromophenolphthalein have been investigated, where possible, in Et_2O, EtOH, C_6H_6, and dioxan, and in acid, neutral, and alkaline solution. Compounds of these types can exist in three forms with different absorptions in the visible, each convertible into the other reversibly. The equilibria between these three forms varies with the solvent, the concn., the p_H of the solution, and the nature and no. of the atoms or radicals attached to the nucleus. The introduction of Br into benzaurin does not affect the general form of the absorption spectrum of this compound, but simply exerts a bathochromic effect. A. J. M.

Coloured tautomeric forms in the benzaurin, phenolphthalein, and phenolsulphonephthalein series. (Mme.) P. Ramart-Lucas (*Compt. rend.*, 1941, **213**, 244—246; cf. A., 1940, I, 145).—Examination of the absorption spectra of benzaurin and phenolsulphonephthalein and their Br_4-derivatives, *o*-cresolsulphonephthalein and its Br_2-derivative, and allied compounds indicates that one of the three coloured tautomeric forms exists mainly in $CHCl_3$, C_6H_6, or H_2O (and to some extent in EtOH or EtOH–AcOH), a second form exists mainly in aq. Na_2CO_3 (and to some extent in neutral medium or in AcOH), whilst the third form appears mainly in acid medium, *e.g.*, HCl–EtOH (and also in EtOH, EtOH–AcOH). Theoretical aspects of the relation between the three forms are discussed. A. T. P.

Spectrophotometric study of glutathione. (Miss) G. A. Anslow and (Miss) E. R. Lyman (*J. Opt. Soc. Amer.*, 1941, **31**, 114—117).—The visible and ultra-violet absorption spectrum of glutathione (I) in aq., EtOH, and NaOH solution has been measured. Bands with centres at 500, 325, 280, and 252 mμ. are observed and are ascribed to the α–β C link in the glutamic acid radical, the SH group of the cysteyl radical, the peptide linking, and the S·S linking of oxidised (I), respectively. The peptide band at 280 mμ. consists of two components; their position, shape, and relative intensities depend on the solvent. F.p. measurements of the mol. wt. of the (I) mol. and of its constituent NH_2-acids before and after irradiation with light of various $\lambda\lambda$ confirm the conclusions that dissociation of (I) at the peptide link is caused by λ 280 mμ., oxidation at the SH group with the formation of S·S linkages by λ 325 mμ., and reduction of previously oxidised mols. by λ 252 mμ. O. D. S.

Absorption of ultra-violet energy by the peptide linkage. (Miss) G. A. Anslow and (Miss) S. C. Nassar (*J. Opt. Soc. Amer.*, 1941, **31**, 118—123).—The absorption spectra of ovalbumin, lactalbumin, and gelatin in aq., NaOH, or EtOH solution have been measured and compared with those of phenylalanine, tryptophan, tyrosine, NHPhAc, stearanilide, and glutathione (cf. preceding abstract). A region of selective absorption characteristic of the peptide group was observed at ~280 mμ., overlapping with that characteristic of tyrosine and tryptophan. The band consists of two components separated in the proteins and NH_2-acid peptides by ~1200 cm.$^{-1}$ and in the anilides by ~850 cm.$^{-1}$ Denaturation by radiation is due to breaking of the peptide link. The energy of the absorbed quantum is ~4·4 e.v. and varies with the solvent. O. D. S.

Spectra of lipoid fractions from human non-cancerous and cancerous tissue. H. S. Penn (*J. Chem. Physics*, 1942, **10**, 145—146).—

Under identical experimental conditions Hg-excited fluorescence in non-cancerous lipoid fractions was < in cancerous. With increasing deproteinisation the fluorescence of the cancerous fraction approaches that of methylcholanthrene. W. R. A.

Excitation of the green fluorescence of mercury by near ultra-violet radiations. R. Lennuier (*Compt. rend.*, 1941, **213**, 169—171).—The green fluorescence is excited by radiations >3000 A. The triplet $^3S \rightarrow {}^3P_{0,1,2}$ is not emitted although, in the spectrum of the incident light, the line 4047 A. is only partly reversed. The visible fluorescence is completely depolarised. The intensity of the visible band varies as a function of the v.d. The mechanism of the excitation process is discussed. W. R. A.

Effect of size of particle on intensity of fluorescence of a phosphor. H. S. Oldham and W. Kunerth (*J. Opt. Soc. Amer.*, 1941, **31**, 102—104).—The intensity of the fluorescence excited by Hg 2537 A. in opaque layers of particles of artificial $ZnBeSiO_3$ phosphors decreases with increasing diameter of the particles (diameters up to $\frac{1}{16}$ in.) according to a straight-line relationship. It is supposed that fluorescence is confined to the surface layers of the particles. O. D. S.

Fluorescence of methylcholanthrene. I. Hieger (*Nature*, 1942, **149**, 300—301; cf. Penn, A., 1942, I, 194).—No differences in fluorescence between fatty extracts of cancer tissues and those of non-cancer tissues have been observed. The fluorescence spectrum of methylcholanthrene exhibits 3 massive bands, the interval between the first and second bands being near Hg 4047 A. The hydrocarbon fluoresces very powerfully in the most sensitive region (violet) of the photo-sensitivity curve of an ordinary plate. A. A. E.

Fluorescence, absorption, and scattering of light in ruby. (Miss) A. Mani (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 52—64).—The first-order lattice spectrum of Al_2O_3 has 18 normal modes of vibration. Two Raman displacements of 376 and 412 cm.$^{-1}$ have been obtained using a single crystal of Al_2O_3. The fluorescence and absorption spectra of ruby have been investigated and the polarisation characteristics of the bands in relation to the directions of the optic axis of the crystal and polarisation of the incident beam. Emission bands fall into two groups: (i) electronic bands caused by transitions of the shielded electrons of the $Cr^{...}$ ions, and (ii) vibrational bands arising from a modulation of the electronic transitions by the crystal lattice vibrations. Shifts in $\nu\nu$ of 8 of the vibrational bands from the principal doublets agree with observed Raman and infra-red $\nu\nu$ of Al_2O_3. Bands on the Stokes and anti-Stokes sides show similar polarisation characters. W. R. A.

Raman effect in deuteronitric acid. G. B. Banerji and B. Mishra (*Indian J. Physics*, 1941, **15**, 359—363).—The Raman spectrum of DNO_3, prepared by the action of D_2O on N_2O_5, consists of 12 displacements. By comparing with HNO_3 isotopic shifts have been calc. and $\nu\nu$ assigned. W. R. A.

Raman spectra of compounds in the gaseous and liquid states. J. R. Nielsen and N. E. Ward (*J. Chem. Physics*, 1942, **10**, 81—87).—An apparatus for exciting the Raman spectra of gases and liquids at temp. up to 300° has been constructed. Spectra of PCl_3, MeCl, MeBr, MeOH, $C_2H_2Cl_2$, $C_2H_2Br_2$, $CHCl_3$, and CCl_4 in the vapour and liquid states have been photographed at the same temp. in juxtaposition. Raman spectra of gaseous *n*-C_5H_{12}, *n*-C_6H_{14}, and D_2O, excited by 2537 A., are recorded. The change in Raman frequencies with the state of aggregation is different for different vibrations and varies markedly from compound to compound. Perpendicular bands of symmetrical top mols. are much less diffuse in the liquid than in the gas, indicating that intermol. forces quench rotation of the mols. in the liquid. Other bands have approx. the same sharpness in both states. W. R. A.

Dielectric loss of solid high polymerides. W. Holzmüller (*Physikal. Z.*, 1941, **42**, 281—293).—In the case of vitreous high polymerides (chiefly polyvinyl compounds) there is a displacement of the max.-loss angle to higher temp. with increase of frequency. This is in agreement with theory. There is also anomalous dispersion of the dielectric const. The increase in dielectric loss at high temp. and low frequency is attributed to ionic conductivity. A. J. M.

Physical properties of alicyclic hydrocarbons. I. Molal volumes of monoalicyclic hydrocarbons at 20°. G. Egloff and R. C. Kuder (*J. Physical Chem.*, 1942, **46**, 281—295).—The mol. vols. (V) at 20° of 515 alicyclic hydrocarbons not containing fused rings have been studied from the viewpoint of isomerism and homology. In a homologous series V can be represented by equations of the form $V = a + bn$, where n is the no. of C atoms and a and b are consts. Comparison with paraffins shows the effect of ring-closure. The data are in complete agreement with Ruzicka's theory of the structure of alicyclic compounds. C. R. H.

Molal volumes of aliphatic hydrocarbons at their m.p. G. Egloff and R. C. Kuder (*J. Physical Chem.*, 1942, **46**, 296—304).—The mol. vol. (V) of liquid aliphatic hydrocarbons at their m.p. can be expressed by $V = a + bn$ (a and b are consts., n = no. of C atoms) provided each homologous series is divided into two sub-series of even and odd C. The equations for any two sub-series may intersect at high vals. of n; to obviate this they can be replaced by one equation of the type $V = a' + b'n \pm c/n$, the + and − signs being used for even and odd members respectively. C. R. H.

Optical properties of thin chromium films. M. Perrot (*Compt. rend.*, 1941, **213**, 238—240).—Transmission and reflexion coeffs., air–metal R, and metal–glass R', for four different $\lambda\lambda$ of transmitted and normally incident Hg arc radiation in the range 3660—5780 A. are obtained for films of thickness 0—100 mμ. deposited on glass. Full tabulated data show sharp max. and min. for R and R' in contrast to available data for Ag, Au, and Pt which, in general, show a uniform increase of R and R' with film thickness, and a general decrease in transmission tending towards almost total absorption, in contrast to ~79% transmission found for Cr. N. M. B.

Dispersion in the far infra-red. L. Kellner (*Physical. Soc. Rep. Progr. Physics*, 1941, **8**, 200—211).—A progress report. W. J.

Synthetic optical crystals.—See A., 1942, I, 180.

Structure of vitreous silica. H. P. Rooksby and L. A. Thomas (*Nature*, 1942, **149**, 273—274).—Experimental support for the view that the bands at 8·18 and 5·80 A. reported by Lu and Chang (A., 1941, I, 193) are spurious is presented, and their conclusion that there is variation of structure between neighbouring regions of a slab of vitreous SiO_2 and in powdering is rejected. Warren's random network theory (A., 1938, I, 67) is satisfactory. A. A. E.

Effect on reflecting power in the near infra-red of liquids absorbed by solids. M. Déribéré (*Compt. rend.*, 1941, **213**, 379—380).—Measurements of % reflexion of finely powdered ZnO, kaolin, pptd. SiO_2, sand, Prussian-blue, and graphite containing 0—9% H_2O show a rapid initial decrease followed by a slow decrease tending to an asymptotic val. corresponding with the val. for a liquid paste. The variation of the effect with the nature of the liquid is shown by data for pptd. Al_2O_3 containing 0—5% of various liquids. N. M. B.

Polarisation of atmospheric haze (air-light). G. M. Byram (*Science*, 1941, **94**, 192—193).—The fraction of light F_θ polarised in a direction making an angle θ with the direction of the sun is related to the fraction, $F_{max.}$, polarised in a direction perpendicular to the sun, by $F_0 = F_{max.} \sin^2\theta/(1 + \cos^2\theta)$, θ being near to 90°. The use of polarising screens in visual work and in photography is discussed. E. R. R.

Absorption of light and heat radiation by small spherical particles. II. Scattering of light by small carbon spheres. R. Ruedy (*Canad. J. Res.*, 1942, **20, A**, 25—32; cf. A., 1942, I, 9).—Theoretical. C spheres for which the ratio of diameter ($2a$) to incident λ is <~1/10 scatter light in all directions; intensity scattered at any angle $\propto V^2\lambda^{-4}$, where V = vol. of particle. As the ratio $2a/\lambda$ increases from $\frac{1}{4}$ to $\frac{1}{2}$ and greater vals. the diffused light collects into a beam of decreasing width which appears as a continuation of the incident ray. Blue light is predominant in the scattered radiation. The size of the particles can be found approx. from the intensity, distribution, and polarisation of the scattered light. W. J.

Dispersion and absorption in dielectrics. II. Direct current characteristics. K. S. Cole and R. H. Cole (*J. Chem. Physics*, 1942, **10**, 98—105; cf. A., 1941, I, 242).—Mathematical. For times, t, $\ll \tau_0$, the generalised relaxation time, the transient current $\propto (t/\tau_0)^{-a}$ (a = const., $0 < a < 1$), whilst for $t \gg \tau_0$ it is $\propto (t/\tau_0)^{-(2-a)}$. The transition occurs when $t \approx \tau_0$. Mica, glass, and amber are considered. W. R. A.

Theory of the specific heat of solids. M. Blackman (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 11—30).—A progress report. W. J.

Valency angle of the carbon atom. G. L. Gombert (*J. Chem. Educ.*, 1941, **18**, 336—337).—A tetrahedral model with specially-opening sides is described, and a method of calculating the angle, 109° 28′, between the C linkings is given. L. S. T.

Modern valency formulæ and the elementary student. G. N. Copley (*Chem. and Ind.*, 1942, 196—197).—It is contended that the modern theory of valency can be introduced to elementary students by always using structural formulæ, made up by using the following rules: (1) each bond between two atoms represents a valency from each atom, (2) a + sign on an atom indicates that one additional valency must be given to this atom, (3) a − sign on an atom shows that a valency must be taken away from the atom. The rules apply to all mols. containing ionic, ordinary covalent, co-ordinate, and mixed co-ordinate–ionic bonds. A. J. M.

Hydrogen bonds involving the sulphur atom. T. G. Heafield, G. Hopkins, and L. Hunter (*Nature*, 1942, **149**, 218).—Cryoscopic measurement of mol. wt. of many thioamides in $C_{10}H_8$ solution shows that those which possess an unsubstituted imino-H (R·CS·NH_2, R·CS·NHR′) exhibit marked mol. association, whilst R·CS·NRR′ are invariably unimol. Hence the association is attributable to S–H–N bonds. Further, the considerable mol. association of NHPh·CSMe is completely checked by the substitution of suitable

o-substituents capable of chelating with the anilido-H. Also thio-acids are associated, whereas their esters, R·CO·SR′, are not. A. A. E.

Two-centre integrals occurring in the theory of molecular structure. C. A. Coulson (*Proc. Camb. Phil. Soc.*, 1942, **38**, 210—223).—A no. of results are given for "one-electron" integrals involving two centres of force. L. J. J.

Polyiodides of cæsium. IV. Molecular formula of cæsium tetra-iodide. S. S. Hubard (*J. Physical Chem.*, 1942, **46**, 227—229).—The diamagnetic nature of the compound and the val. of the magnetic susceptibility ($-220{\cdot}5 \times 10^{-6}$ c.g.s. units per mol.) support the view that its formula is Cs_2I_8, the most probable arrangement in the polyiodide group being the sharing of an I_2 mol. between two CsI_3 groups, *i.e.*, $Cs^+[^-I_3{-}I_2{-}I_3^-]Cs^+$. C. R. H.

Steric hindrance in organic solids. B. S. Biggs (*J. Chem. Educ.*, 1941, **18**, 224—226; cf. A., 1940, I, 98).—Limiting deviations from perfect symmetry that will still permit compounds of the substituted C_6H_6 class to rotate in the solid state are discussed. In penta-substituted benzenes, *e.g.*, C_6HMeCl_4 and trichloro-*o*- and -*m*-xylenes, one indentation of the periphery equiv. in size to the space occupied by one substituent does not prevent rotation of the mol. in the temp. range immediately below the m.p. In $C_6Me_5{\cdot}CN$, the deviation from perfect symmetry, viz., protrusion in the plane of the ring, is slightly < the max. that still permits rotation. Of hexa-substituted C_6H_6 mols. with protrusions out of the plane of the ring only o-$C_6Me_4(NO_2)_2$ rotates, and this only above 154°. It is suggested that the protrusions outside the plane of the ring in the other mols. must block each other enough to stop rotation. L. S. T.

Aromatic problem. II. Density distribution and zero-point energy of the *B*-electrons of aromatic compounds. O. Schmidt (*Physikal. Z.*, 1941, **42**, 307—319; cf. A., 1942, I, 163).—The density and the zero-point energy of conductivity electrons for aromatic compounds are only slightly < for the conductivity electrons of graphite. The "effective no." of "free" electrons, *i.e.*, the proportion of free electrons to the total no. of *B* electrons, increases continuously in passing from C_6H_6, through hydrocarbons with a higher % of C, to graphite. The "metallic" character of the aromatic linking is due to the high % of free *B* electrons. The calculation of diamagnetic anisotropy from the density distribution of *B* electrons is considered. 2-, 6-, and 10-groups of *B* electrons are the smallest completely closed systems, and the density and zero-point energy of the *B* electrons in each group are different. The density in $C_{10}H_8$ is > in C_6H_6. It is increased by substitution, which thus causes a decrease in the excitation and activation energies. Carcinogenic hydrocarbons and other aromatic compounds of this class have two groups of *B* electrons. The density of *B* electrons increases in passing from anthracene to phenanthrene. Carcinogenic hydrocarbons are characterised by relatively low excitation energy, the lowest being ~3·2 e.v. It is assumed that this energy will be still further lowered by adsorption on the body-substance. Since, in the excited state, uncoupled valency electrons are present, possessing electron affinity, the carcinogenic properties of these compounds depends on the electron affinity of their comparatively easily produced excited state, which lowers the quantum jump in neighbouring mols., *e.g.*, protein mols. The wave-mechanics treatment of the aromatic problem is discussed. A. J. M.

Determination of intermolecular energies by inductive analysis. W. J. C. Orr (*Proc. Camb. Phil. Soc.*, 1942, **38**, 224—230).—Mathematical. L. J. J.

Centres of van der Waals attraction. F. London (*J. Physical Chem.*, 1942, **46**, 305—316).—Mathematical. The theory of intermol. attraction is extended to anisotropic force centres and to mols. containing extended electronic oscillators. The rôle possibly played by van der Waals forces in the case of rubber is discussed. C. R. H.

Mean "tarrying" path (Verweilweg). K. Bennewitz (*Z. physikal. Chem.*, 1941, **B**, **49**, 293—296).—Theoretical. The path of a mol. which accidentally enters a defined area between the time of entering and that of leaving is called the "tarrying" path (Verweilweg). An expression for this is deduced. A. J. M.

III.—CRYSTAL STRUCTURE.

Reflexion and scattering of *X*-rays with change of frequency. I. Theoretical. II. Experimental. (Sir) C. V. Raman (*Proc. Roy. Soc.*, 1942, **A**, **179**, 289—301, 302—314).—I. The theory is given of two new phenomena, the quantum reflexion and the quantum scattering of *X*-rays. Quantum or modified scattering is due to the excitation of elastic low-frequency vibrations of the lattice by the *X*-ray photon; it has but small intensity and is distributed over a wide range of solid angles. The view that ascribes extra spots on Laue diagrams to elastic vibrations is held to be erroneous. Quantum or modified reflexion is due to excitation of infra-red or characteristic high-frequency vibrations of the crystal lattice by the *X*-rays. These reflexions are more intense, and the directions in which they appear are discussed. The frequency change is a consequence of both classical and quantum points of view, but the law of temp.-dependence of intensity is different in classical and quantum formulations.

II. Experimental confirmation of the theory is given. The specular character and the geometric law of quantum reflexion are demonstrated. Differences between diamond and other crystals are discussed, and the changes of intensity at high and low temp. investigated. G. D. P.

Extra reflexions from the two types of diamond. (Mrs.) K. Lonsdale (*Proy. Roy. Soc.*, 1942, **A**, **179**, 315—320).—Two kinds of extra reflexions are identified on well exposed photographs of diamonds. All diamonds show primary diffuse reflexions which are temp.-sensitive and correspond to the diffuse reflexions observed in all other crystals. Type-I diamonds alone show the secondary reflexions which are not temp.-sensitive but are strongly structure-sensitive. There is as yet no adequate explanation of the significance of these reflexions. G. D. P.

Diffuse scattering of *X*-rays by crystals. The Faxén–Waller theory and the surfaces of isodiffusion for cubic crystals. H. A. Jahn (*Proc. Roy. Soc.*, 1942, **A**, **179**, 320—340).—The Faxén–Waller theory of scattering of *X*-rays by thermally excited lattice vibrations is given, and the shape of the surfaces of isodiffusion surrounding the points of reciprocal space for cubic crystals is investigated. In substances with high elastic anisotropy these surfaces differ markedly from spheres and differ for different crystal planes. The theory is applied to the case of Na. G. D. P.

***X*-Ray study of the elastic constants of metals.** (Mrs.) K. Lonsdale and H. Smith (*Nature*, 1942, **149**, 21—22).—Data for Na illustrate the fact that the diffuse *X*-ray reflexions from single crystals of alkali metals are related to the elastic consts. in accordance with Jahn's interpretation of Waller's theory. For Pb the reflecting regions in reciprocal space are similar to those for Na. For W the prediction of small, elliptical diffuse spots which should disappear at a very small angular distance from the Bragg position is verified by experiment. It is considered proved that the relation of diffuse to normal (Bragg) reflecting power for any set of planes is governed by the actual vals. of the elastic consts. and not primarily by the crystal structure. A. A. E.

Crystallisation in an inflated rubber balloon. A. Schallamach (*Nature*, 1942, **149**, 112).—*X*-Ray reflexions from an inflated rubber balloon indicated a unit cell having a 8·5, b 8·2, c 12·6 A., monoclinic structure and $\beta = 83°\ 20'$ being assumed. The dilatation of the rubber skin appears to produce an oriented crystallisation, the crystallites tending to arrange themselves with the b–c plane in the plane of the skin. A. A. E.

New structure of carbon. H. Lipson and A. R. Stokes (*Nature*, 1942, **149**, 328).—"Extra" lines in *X*-ray photographs of graphite (A., 1940, I, 348) are attributed to the presence of ~10% of another structure closely related to graphite. The new structure, which is rhombohedral although it may be referred to hexagonal axes, belongs to the space-group $R\bar{3}m$ ($a = 3{\cdot}635$ A., $\alpha = 39{\cdot}49°$) and has atoms at $\pm(\frac{1}{8}, \frac{1}{8}, \frac{1}{8})$. A. A. E.

***X*-Ray diffraction of allotropes of selenium.** K. D. Gupta, S. R. Das, and B. B. Ray (*Indian J. Physics*, 1941, **15**, 389—399).—Monoclinic Se is transformed monotropically into hexagonal Se in 1 hr. at 120° and in >17 days at 65°. The transformation has been followed by *X*-ray diffraction measurements. Amorphous varieties soften at 38° but exhibit three bands coinciding in position and intensity with three distinct groups of lines of the cryst. varieties. Vitreous Se devitrifies even at 28° and the devitrified mass is cryst. A sample of vitreous Se kept for 7 years at <27° had a cryst. surface but the interior gave diffuse bands. At low temp. devitrified Se is monoclinic and at high temp. hexagonal. Band spacing is ∝ period of heating and size of crystallite, in agreement with the theory of Lennard-Jones (*Z. Krist.*, 1930, **75**, 250) that the lattice const. is a function of particle size. The band spacing of amorphous Se coagulated from colloidal Se is 3·8 A.; that of vitreous Se heated for 60 hr. at 38° is 3·4 A. W. R. A.

Weakening of intensity of *X*-rays by a lithium beryllium borate glass. S. D. Gertsriken and M. A. Revutskaja (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 1144—1152).—A glass prepared from $BeCO_3$ 1·00, Li_2CO_3 1·07, and H_3BO_3 7·17 parts is sufficiently transparent to *X*-rays to be used instead of Lindemann glass. Its effective at. no. is 7·02, and that of a Li_4Be tetraborate is 7·08 (theoretical vals. 7·03 and 7·10, respectively). Ch. Abs. (*w*)

***X*-Ray diffraction and physical properties of potassium borate glasses.** R. L. Green (*J. Amer. Ceram. Soc.*, 1942, **25**, 83—89).—The co-ordination of the B atoms changes from 3 to 4 as the K_2O content increases to 22%; beyond this point the effect diminishes again. The strengthening of the loose BO_3 structure by the BO_4 structure is accompanied by a decrease in the thermal expansion and a rise in the transformation and softening temp. and isothermal η, the respective min. and max. vals. occurring at a composition of

22% of K_2O. The d and n also increase over the range 0—22% of K_2O. J. A. S.

"Notable points" occurring simultaneously on cube and spherical surfaces. R. Reinicke (*Z. Krist.*, 1941, **103**, 355—358; cf. *ibid.*, 1937, **98**, 89—106).—An arithmetical development of a speculative structural theory based on tetrahedra, cubes, and spheres. A. J. E. W.

A. C. Gill's development of the concept of unique diameters in crystallography. J. D. Burfoot, jun. (*Amer. Min.*, 1941, **26**, 617—626).—Criteria, distribution, definitions of the six crystal systems in terms of unique diameters, selection of axes of reference, and applications of the concept are discussed. The concept of a unique diameter provides a basis for the definition and treatment of systems founded on inherent, independent properties, and not on hypothetical axes of reference, or on groupings of classes. L. S. T.

Atomic arrangement in the sulphur unit cell. W. Brown (*J. Chem. Educ.*, 1941, **18**, 182—184).—Details for the construction of a model, using $CH_2{:}CMe{\cdot}CO_2Me$, are given. L. S. T.

Structure analogies of uranium and thorium phosphides. (Frl.) M. Zumbusch (*Z. anorg. Chem.*, 1941, **245**, 402—408).—Structure analogies as revealed by X-ray diagrams of U and Th phosphides are discussed. U_3P_4 and UP are isomorphous with Th_3P_4 and the "ThP" phase respectively. C. R. H.

Diffraction of cathode rays by vivianite. T. Yamagnchi (*Proc. Phys.-Math. Soc. Japan*, 1936, **18**, 372—379).—X-Ray and electron-diffraction data show that $Fe_3(PO_4)_2{,}8H_2O$ has a base-centred monoclinic unit cell with a 9·997, b 13·37, c 4·696 A. ($a:b:c$ = 0·749 : 1 : 0·354), β 104° 16′. Electron reflexions from a (010) cleavage face give a mean internal potential of 10·0 v.; the apparent n falls rapidly from higher to lower orders. Ch. Abs. (*w*)

X-Ray diffraction studies on heavy-metal iron cyanides. H. B. Weiser, W. O. Milligan, and J. B. Bates (*J. Physical Chem.*, 1942, **46**, 99—111).—X-Ray diffraction studies show that Ti_3X_4, TiX, InX, Prussian-blue, Turnbull's blue, Al_4X_3, Sc_4X_3, In_4X_3, Zn_3X_2, Cd_3X_2, Cu_3X_2, and Cu_2X, where X = $Fe(CN)_6$, form an isomorphous series with face-centred cubic symmetry. La_4X_3, LaX, and Nd_4X_3 have more complicated structures. The compositions of Prussian-blue and Turnbull's blue are discussed. Diffraction data, density vals., and oxidation–reduction potentials for the reaction $Fe''' + e \rightarrow Fe''$ and $X''' + e \rightarrow X''''$ indicate that the two compounds may be identical, the formula being either Fe_4X_3 or Fe_3X_2. C. R. H.

Variation of the magnetic properties of antimony with electron concentration.—See A., 1942, I, 169.

Transition state theory of diffusion in crystals. R. M. Barrer (*Trans. Faraday Soc.*, 1942, **38**, 78—85; cf. A., 1942, I, 90).—Equations of the transition state theory are developed for the Schottky, Frenkel, and zeolitic mechanisms of diffusion. The simplest val. of D_0 in $D = D_0e^{-E/RT}$ is $\sim 3 \times 10^{-3}$ cm.^{2} sec.$^{-1}$, and deviations from this val. imposed by the different mechanisms cover most of the observed range. The effect of high pressures on diffusion and conductivity consts. is discussed quantitatively. F. L. U.

Friction between solid bodies. R. Schnurmann (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 71—89).—A progress report. W. J.

Crystal growth. V. Rosický (*Z. Krist.*, 1941, **103**, 328—352).—A detailed study is made, by Fedorov's method and with a Goldschmidt two-circle goniometer, of the orientation of growth faces in freely-growing crystals of $CuSO_4{,}5H_2O$ and $KAl(SO_4)_2{,}12H_2O$, and of the disposition of individual needle crystals in parallel and radial aggregates (andalusite, amphibole, and gypsum, and sucrose, respectively). The effects of the habit and symmetry of the crystals are discussed. A. J. E. W.

Projection sphere; an aid in the study of crystals. V. Rosický (*Z. Krist.*, 1941, **103**, 353—354).—The device described consists of a sphere 40 cm. in diameter on which the angles of a crystal can be plotted during goniometric measurements, without the use of projections. It facilitates the correct orientation of damaged or imperfect crystals. A. J. E. W.

Connexion between light absorption and space arrangement of molecular aggregates. G. Scheibe, R. Müller, and R. Schiffmann (*Z. physikal. Chem.*, 1941, **B**, **49**, 324—333).—The arrangement of mols. of ψ-*iso*cyanine in aggregates is discussed. The distance between the two N atoms of the mol. agrees almost exactly with the separation of the K^+ in a mica crystal. Two arrangements are possible, either a staircase, or a ladder type. The latter is favoured. A. J. M.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Electromagnetic investigation of the mechanism of electrical conductivity in platinum and rhodium. Connexion between conductivity and texture. R. Schulze (*Physikal. Z.*, 1941, **42**, 297—307).—According to the theory of free isotropic electron gas, the max. effect exerted on the resistance of a metal by a magnetic field perpendicular to the direction of the current is ~0·01%. In practice this val. is exceeded even for moderate fields; in the case of polycryst. Pt and Rh in a transverse magnetic field of 40,000 gauss, at the temp. of boiling He, an increase of resistance of ~200% was found. The type of conductivity is dependent on the no. of valency electrons. For Rh the increase in resistance is considerable even for small magnetic fields, and seems to reach a saturation val. at ~30,000 gauss. With Pt the increase in resistance is more rapid with increasing field strength, and saturation is not reached in the fields investigated (~40,000 gauss). This agrees with results for other metals, where it is found that elements with an even at. no. show an unlimited increase in resistance with increasing magnetic field strength, whilst those with an odd at. no. reach saturation. The results can be shown on a Kohler diagram. Deviation from the smooth curve may be produced by a difference in texture, caused, for example, by drawing the metal into wire. The resistance of Pt and Rh at low temp., in the absence of a magnetic field, does not follow a single exponential law, but varies with T^2 at He temp. and with higher powers of T at H temp. A. J. M.

Effect of isotopic constitution on electrical resistance and superconductivity of lead. E. Justi (*Physikal. Z.*, 1941, **42**, 325—327).—Isotopic constitution gives rise to very little difference in the resistance of ordinary Pb and U-Pb at various temp. U-Pb is a superconductor, and has a transition temp. identical with that of ordinary Pb. A. J. M.

Paramagnetism of aqueous solutions of copper nitrate.—See A., 1942, I, 201.

Diamagnetism of the halogens. S. R. Rao and S. R. Govindarajan (*Proc. Indian Acad. Sci.*, 1941, **15**, **A**, 35—51).—Vals. of χ for Br and I are $-0{\cdot}346$ and $-0{\cdot}364 \times 10^{-6}$. Vals. of χ for solutions (solvents in brackets) are given for Cl_2 [AcOH, $CHCl_3$, *cyclo*hexane (I)], Br [CCl_4, $CHCl_3$, AcOH, and (I)], and I [CS_2, C_6H_6, EtOH, and (I)] and vals. for the halogens are calc. For Cl_2 the vals. range $CHCl_3 \approx$ AcOH > (I) ≈ element; for Br AcOH > $CHCl_3 \approx CCl_4$ > (I) ≈ element; for I C_6H_6 > EtOH > CS_2 > (I) ≈ element. Tentative explanations of ionisation and formation of loose mol. compounds between solute and solvent are given and correlation with optical properties is attempted. W. R. A.

Fundamental laws and definitions in physics. I. Ohm's law. II. Specific heat and Newton's law of cooling. III. Mass. C. W. Hansel (*Proc. Physical Soc.*, 1942, **54**, 151—159, 159—164, 164—204).—I. With a view to arriving at the best elementary treatment of Ohm's law a survey is given of the nature of Ohm's work, different statements of the law in textbooks, standardisation of notation, and a simple illustrative experiment. Conclusions are tabulated.

II. Definitions of thermal capacity and sp. heat are examined, Newton's law of cooling and the cooling calorimeter are discussed, and recommendations are proposed.

III. A detailed discussion is given of dynamical quantities and their definition, the present chaotic systems of units, their treatment in various textbooks, remarks on mass and wt. by engineers, mathematicians, and physicists, and reports of committees on teaching. Recommendations on simplification are suggested. N. M. B.

Effects of heat capacity lag in gas dynamics. A Kantrowitz (*J. Chem. Physics*, 1942, **10**, 145).—Measurements of the velocity and absorption of sound have shown that gases absorb their vibrational heat content exponentially with a measurable relaxation time. The significance of this in gas dynamics is indicated, and an apparatus is briefly described by which energy dissipations in the flow of gases, and hence of relaxation times, can be measured. W. R. A.

Heat capacity of some pure liquids and azeotropic mixtures. A. K. Shdanov (*J. Gen. Chem. Russ.*, 1941, **11**, 471—482).—C_p of CCl_4 is 0·2013, 0·2053, and 0·2095 at 5·5°, 24·8°, and 46·1°; of $Pr^{\alpha}OH$: 0·5431, 0·5623, 0·5781, 0·5951, and 0·6480 at 6·5°, 17·6°, 24·4°, 30·9°, and 45·6°; of $Bu^{\beta}OH$: 0·5322, 0·5916, and 0·6600 at 5·1°, 23·1°, and 45·8°; of C_6H_6: 0·4044, 0·4141, and 0·4316 at 8·2°, 22·4°, and 45·6°; of PhMe: 0·3871, 0·4077, and 0·4312 at 5·3°, 23·6°, and 47·2°. The ratio MC_p/T_0 for each homologous series (Kolosovski, A., 1934, 1300), M being the mol. wt. and T_0 ° K. the b.p., is a const.; C_p is that for T_0. The C_p of the azeotropic mixtures of C_6H_6 with $Pr^{\alpha}OH$ or COMeEt, of PhMe with $Pr^{\alpha}OH$, $Bu^{\beta}OH$, and *iso*-$C_5H_{11}{\cdot}OH$, and of CCl_4 with $Pr^{\alpha}OH$, $Pr^{\beta}OH$, and $Bu^{\beta}OH$ is determined at several temp. and extrapolated to the b.p. C_p vals. are usually > the sums of the C_p of the components for positive azeotropic mixtures, and < the sums for negative ones. J. J. B.

Vapour pressures of the phosphorus dichloronitrides and the existence of an equilibrium between "mineral rubber" and its vapour. H. Moureu and A. M. de Fiquelmont (*Compt. rend.*, 1941, **213**, 306—308).—By means of a closed Pyrex apparatus fitted with a glass manometer the v.p. of $(PNCl_2)_3$, $(PNCl_2)_4$, and their polymerisation product $(PNCl_2)_n$ ("mineral rubber") have been measured at 114—257°, 123·5—275°, and 350—450°, respectively. The mean heats of vaporisation are 13, 15·5, and 15·5 kg.-cal. per g.-mol., respectively. The b.p. of $(PNCl_2)_4$, determined by extrapolation,

is 325·5°. The analogy between the PN and CN groups is pointed out. J. W. S.

Temperature-dependence of viscosity, dielectric relaxation, and place interchange processes in amorphous solids. W. Holzmüller (*Physikal. Z.*, 1941, **42**, 273—281).—The variation with temp. of η and dielectric relaxation in liquids and amorphous solids may be explained by considering the place interchange phenomena in which the elementary units of these substances take part. In the case of liquids, the potential waves to be exceeded are small and uniform in size, so that there is only one relaxation time, but in amorphous solids the potential waves are of various sizes and give rise to a no. of relaxation times. The variation of these with temp. can be obtained from the Boltzmann principle, the results agreeing with the exponential formula for the variation of the η with temp. when one relaxation time is considered. At high temp. the spectrum of the relaxation time crowds together, thus explaining the increase in the max. loss angle. It is impossible to express the variation of η of a substance with temp. through all the stages from the liquid state to the highly viscous melt by a single exponential function. A. J. M.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Influence of diffusion on the propagation of shock waves. T. G. Cowling (*Phil. Mag.*, 1942, [vii], **33**, 61—67).—Mathematical. It is shown that in the propagation of shock waves through a mixture of gases there is a variation of composition in the track of the wave which becomes large when the densities are sufficiently different. F. J. G.

Scattering of light in binary liquid mixtures. D. V. Rao (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 24—34).—The isothermal variation of the depolarisation components, ρ_u, ρ_v, and ρ_h, with variation in concn. of CS_2–MeOH mixtures indicates mol. clustering in the crit. composition mixtures at room temp. Existing theories have been tested. ρ_h depends on the shape rather than on the size of the container. W. R. A.

Propagation of supersonic waves in liquid mixtures and intermolecular forces. I. Alcohols in water. R. Parshad (*Indian J. Physics*, 1941, **15**, 323—336).—Supersonic velocities in aq. MeOH, EtOH, and Pr^{a}OH increase with concn. of alcohol and pass through a max. Compressibilities exhibit min. with increasing concn. of alcohol. A theory of mol. force fields has been developed and is used to explain the results. On mixing, the alcohol and H_2O de-associate each other and random mol. motion and distribution result. W. R. A.

Paramagnetism of aqueous solutions of copper nitrate. J. Amiel (*Compt. rend.*, 1941, **213**, 240—242).—In view of discordant available data, susceptibility measurements at 20° for 0·1—4·0M. solutions are reported. Mol. magnetic susceptibilities and at. susceptibilities of Cu are calc.; the latter vals. decrease slightly with increasing dilution and the average val. in the concn. range is 1665×10^{-6}. Corresponding data for $CuSO_4$ and $CuCl_2$ are plotted for comparison. N. M. B.

Derivation of the f.p. equation. H. M. Teeter (*J. Chem. Educ.*, 1941, **18**, 393).—A simplified derivation of this equation is presented. L. S. T.

Anomalous mixed crystals. IV. Anomalous miscibility of organic substances. A. Neuhaus (*Z. Krist.*, 1941, **103**, 297—327; cf. A., 1930, 682; 1938, I, 68, 347).—From rotation and Schiebold–Sauter *X*-radiograms, Me-red (**I**) has *a* 8·45, *b* 11·6, *c* 9·30 A. [*a* : *b* : *c* (crystallographic) 0·732 : 1 : 0·800]; *a* 115° 20′, β 125° 40′, γ 66°; *V* 668 cu. A.; 2 mols. per unit cell; $\rho_{obs.}$ 1·31, $\rho_{calc.}$ 1·334; morphological data are given, and twinning characteristics are described. *o*-$C_6H_4(CO_2H)_2$ (**II**) has *a* 5·04, *b* 14·25, *c* 9·52 A., β 86° 30′; *V* 681 cu. A.; 4 mols. per unit cell. A comparison of the *X*-ray data indicates that the {110} planes of (**I**) and (**II**) are closely similar in geometrical pattern and linking type; such planes are termed " affinitive " planes. Since the distances between these planes and the unit cell vols. are also simply related there is a " pseudo-three-dimensional " analogy between the structures, which explains their anomalous miscibility. A structure for (**II**), involving double mols., is derived. Anomalous miscibility in the systems (**II**)–methylene-blue (**III**), and $Ba(NO_3)_2$– and $Pb(NO_3)_2$–(**III**), is similarly explained. The mode of growth of the mixed crystals is discussed. Systems showing anomalous miscibility form three classes having the following structural features: (i) linking forces similar, point-lattices partly isomorphous [*e.g.*, (**I**)–(**II**), (**II**)–(**III**)]; (ii) linking forces dissimilar, point-lattices strictly isomorphous (*e.g.*, ZnS–FeS, Al_2O_3–Fe_2O_3); (iii) linking forces dissimilar, point-lattices partly isomorphous [*e.g.*, $Pb(NO_3)_2$– and $Ba(NO_3)_2$–(**III**)]. A. J. E. W.

Miscibility gaps. II. System methyl acetate–carbon disulphide. K. Clusius and H. Ulmke (*Z. physikal. Chem.*, 1941, **A, 189**, 331—334; cf. A., 1942, I, 19).—The system MeOAc–CS_2 shows a region of incomplete miscibility at low temp.; the upper crit. solution temp., the lowest yet recorded, is −52·6° and the crit. composition 61 mol.-% of CS_2. J. W. S.

Solubility diagrams for the systems ethylidene diacetate–acetic acid–water and vinyl acetate–acetone–water. J. C. Smith (*J. Physical Chem.*, 1942, **46**, 229—232).—Solubility data for the two systems are recorded in tabular and triangular diagrammatic form. C. R. H.

Solubility generalisations. C. J. Heimerzheim (*J. Chem. Educ.*, 1941, **18**, 377).—Solubilities of common salts are classified. L. S. T.

Solubility of basic lead carbonate and of lead sulphate in dilute solutions.—See B., 1942, III, 118.

Mixed solvents for soaps. S. R. Palit (*Current Sci.*, 1941, **10**, 436—437).—Mixtures of mono- and poly-hydric alcohols of optimum composition will give solutions containing >10% of an alkali metal soap at room temp.; at temp. >40° solutions sufficiently conc. to give transparent gels can be prepared. The solvent action is considerably increased by addition of a hydrocarbon, which permits gel formation at room temp. The component solvents used, in decreasing order of efficiency, are as follows: Bu$^\beta$OH, *iso*-C_5H_{11}·OH, Pr^{a}OH, EtOH, MeOH; $(CH_2{\cdot}OH)_2$, $OH{\cdot}CH_2{\cdot}CHMe{\cdot}OH$, $(OH{\cdot}[CH_2]_2)_2O$, glycerol, $OH{\cdot}[CH_2]_3{\cdot}OH$ (" latent solvents "); C_6H_6, turpentine, *cyclo*hexane, C_7H_{16}, C_6H_{14} (" couplers "). Preliminary electrical conductivity and ultrafiltration experiments indicate that the solutions are of a truly mol. type. A. J. E. W.

Complex formation associated with the distribution of ferric chloride between water and ether. B. V. Nekrassov and V. V. Ovsiankina (*J. Gen. Chem. Russ.*, 1941, **11**, 573—576).—When an aq. solution of $FeCl_3$ and HCl is extracted with Et_2O, the ratio Cl : Fe in the Et_2O is near 4 (3·85—4·10) when HCl is 2—6N. and $FeCl_3$ 1—4N. When [HCl] is <1N., the ratio is less (*e.g.*, 3·4—3·7 for pure $FeCl_3$), and for 9N- or 10N-HCl it rises to 5 or 5·4. The solubility of Et_2O in the aq. phase is raised by HCl, especially at concns. >5N., whereas $FeCl_3$ increases the solubility of H_2O in Et_2O. It is concluded that Et_2O extracts from $FeCl_3$–HCl solutions $H[FeCl_4(H_2O)_2]$; when [HCl] is low, Et_2O contains $H[FeCl_3(OH)(H_2O)_2]$, and when [HCl] is very high, $H_2[FeCl_5(H_2O)]$ and $H_3[FeCl_6]$ are transferred to Et_2O. Vals. are given for the distribution of HCl between H_2O and Et_2O. J. J. B.

Thermodynamic derivation of Fowler's adsorption isotherm. G. S. Rushbrooke (*Proc. Camb. Phil. Soc.*, 1942, **38**, 236—239).—Rushbrooke and Coulson's derivation of Langmuir's isotherm (A., 1940, I, 291) is extended to cases in which the absorption energy is dependent on the no. of adsorbed atoms or mols. If the relation is linear, Fowler's isotherms for crit. adsorption are obtained. L. J. J.

Autosorption at the liquid–vapour boundary. G. L. Starobinetz and A. V. Pamfilov (*J. Gen. Chem. Russ.*, 1941, **11**, 493—500).—It is assumed that the liquid–vapour boundary of chemically homogeneous substances has a higher density than either of the bulk phases, and for this accumulation an equation is derived involving mainly the heat of evaporation L and the temp.-coeff. of the surface tension $d\gamma/d\theta$. For various substances (ranging from A to H_2O) the accumulation is $\sim 10^{-10}$ mol. per sq. cm. The existence of the autosorption accounts for the deviations from Stefan's law connecting L with γ and $d\gamma/d\theta$. J. J. B.

Adsorption of bromine in the crystal lattice of graphite. Bromographite. W. Rüdorff (*Z. anorg. Chem.*, 1941, **245**, 383—390).—Several types of graphite adsorbed ~84% of Br when exposed to its vapour at room temp. The adsorbed gas was easily removed in a current of air. *X*-Ray analysis shows that bromographite is a solution of Br in the graphite lattice and is not a compound analogous to fluorographite. The layers of C in bromographite are unequally spaced, a distance of 3·35 A. alternating with a distance of 7·05 A., and it is between the wider spaced layers that the Br atoms or mols. form a layer. C. R. H.

Adsorption of alcohols at the salicylaldehyde-water interface. G. C. H. Ehrensvärd and D. F. Cheesman (*Science*, 1941, **94**, 23—25).—E.m.f. of the cell $Hg|Hg_2Cl_2|0{\cdot}0001N\text{-}KCl|(1)$ salicylaldehyde (**I**)$|$saturated $KCl|(2)$ (**I**) + alcohol$|0{\cdot}0001N\text{-}KCl|Hg_2Cl_2|Hg$, where alcohols are titrated into (2), are measured. With alcohols containing odd nos. of C atoms, especially *n*-heptyl and *n*-nonyl, large initial decreases in e.m.f. are observed. In the cell $Hg|Hg_2Cl_2|$ saturated $KCl|(1)|(2)|$saturated $KCl|Hg_2Cl_2|Hg$, when (1) and (2) are separated by a long diffusion path, the effect is very small; the principal phase boundary effect is thus at the (2)/0·0001N-KCl interface. The relation of the observed effect to sp. adsorption of alcohols at the (**I**)/H_2O interface is discussed. E. R. R.

Sorption of water by Cellophane.—See B., 1942, II, 189.

Surface activity of alcohols in bromobenzene. A. V. Pamfilov and G. L. Starobinetz (*J. Gen. Chem. Russ.*, 1941, **11**, 501—506).—Using the max. bubble pressure the γ of some solutions of MeOH, EtOH, Pr^{a}OH, and Bu^{a}OH in PhBr is measured at 20°, 30°, and 40°. The curves for γ against concn. (mol. per c.c.) are almost linear for MeOH and EtOH and agree with Schischkovski's equation

for the other alcohols. The energy change associated with the transfer of a CH_2 group into the surface is for H_2O ~3 times as large as for PhBr. Traube's rule holds for PhBr but the coeff. is 1·5 instead of 3 as in H_2O. J. J. B.

Behaviour of the static surface tension of solutions of sodium oleate as a function of concentration. M. Herquet (*Compt. rend.*, 1941, **213**, 302—304).—Using a completely automatic tensimeter which permits the determination of the surface tensions (γ) of a series of solutions in an atm. of N_2, the vessels containing the solutions having a surface : vol. ratio of 12·035, it has been confirmed that Na oleate solutions show a series of min. in their γ-concn. curves (cf. du Nouy, A., 1925, ii, 109). The mean val. of the Avogadro no., deduced on the assumption that each min. corresponds with the completion of a perfect unimol. film of the surface layer, is $6·01 \times 10^{23}$. J. W. S.

Behaviour of solutions of various sodium soaps at the interface between vaseline oil and water. R. Cavier (*Compt. rend.*, 1941, **213**, 70—71).—The no. of drops of solutions of various Na soaps, isotonic with blood serum, and buffered at p_H 9, given from a tube in air and in vaseline oil has been compared. Like surface tension, the interfacial tension between vaseline oil and H_2O is lowered by soaps. In general the no. of drops formed by the various soap solutions is in the same order in air and in oil. For the soaps of unsaturated fatty acids, the lowering of the interfacial tension is the greater, the larger is the no. of double linkings. In the case of soaps from chaulmoogra oil, and particularly Na hydnocarpate, the effect on interfacial tension is considerably > that on surface tension. A. J. M.

Expansion of nnimolecular layers of mixed saturated fatty acids. F. Kane (*Proc. Roy. Irish Acad.*, 1942, **47**, **B**, 265—273).—At const. pressure unimol. films containing a mixture of myristic, palmitic, and stearic acids expand irregularly with rising temp. The irregularities correspond with the expansion characteristics of the components and it is inferred that no mol. association or complex formation can occur and that attempts to predict the behaviour of fatty acid films from the known behaviour of the constituents (A., 1940, III, 56) are justified. J. W. S.

Permeability of Cellophane [to ions].—See A., 1942, I, 206.

Electrical method for converting an aërosol into an organosol. M. Pauthenier and E. Brun (*Compt. rend.*, 1941, **213**, 313—314).—The electrical method of transferring fog droplets into a suspension in oil (*ibid.*, **212**, 1081) has been applied to the production of suspensions of soot, charcoal, talc, and colouring matters in oils. J. W. S.

Stability properties of hydrophobic colloidal solutions. S. Levine and G. P. Dube (*J. Physical Chem.*, 1942, **46**, 239—280).—Theoretical. A no. of applications of the mutual energy of two colloidal particles are given. An expression for the interaction of two particles is derived in which the energy max. determines the stability properties of a sol fairly satisfactorily if coagulation is slow. This energy max. depends on particle charge, ζ-potential, electrolyte concn., valency of the ions, and particle radius (r). The concept of the pptg. ion is shown to be of limited validity. In the phenomena of charge reversal by tervalent ions, theory predicts that the crit. ζ-potential in the second region of stability is > that in the first. The van der Waals const. calc. from the crit. ζ-potential, electrolyte concn., and r has approx. the same val. for different electrolytes in the same sol, in agreement with theory. If ζ-potential is independent of r the energy max. in the coagulation zone increases with r if r is small, but reaches a max. and then decreases if r is large. This is consistent with secondary particles being formed from smaller primary particles and with the phenomenon of stepwise coagulation. C. R. H.

Hydration of colloidal sulphur. T. R. Bolam and A. K. M. Trivedi (*Trans. Faraday Soc.*, 1942, **38**, 140—147).—The hydration of S in Odén sols is calc. from the distribution of a reference substance (NaCl, free Na polythionate, raffinose, sucrose) between the sol and its intermicellar liquid or between two sols of unequal S content, on the assumption that none of the reference substance is present in the micelles or coagulum. The results indicate that the micelles in Odén sols are hydrated. Reversible coagulation ($Li^·$ or $Na^·$) is accompanied by partial dehydration, and irreversible coagulation ($K^·$ or $Ba^{··}$) by complete dehydration. No appreciable amount of $Cl^·$ is adsorbed by the micelles in undialysed sols. F. L. U.

Effect of potassium salts on aluminium oxychloride hydrosol. M. W. Kelly and K. S. Rostler (*J. Physical Chem.*, 1942, **46**, 317—325).—The sols show no change in p_H when aged at room temp. but become more acid when aged at 80—85°. If the heated sol is allowed to age at room temp. a partial reversal of the p_H change is observed. The relative effectiveness of K salts in raising p_H is oxalate > citrate > malonate ≧ maleate > succinate = malate ≧ KOAc > lactate = glycollate ≧ tartrate > K_2SO_4 > KCl. The results are explainable on the Thomas theory. The pptg. power of these salts is not directly related to the valency of the pptg. ion, the order of decreasing pptg. power being K_2SO_4 > citrate > tartrate = succinate = oxalate = malonate = malate > maleate > glycollate > lactate > KOAc > KCl. C. R. H.

Structural precipitates : silicate garden type. T. H. Hazlehurst (*J. Chem. Educ.*, 1941, **18**, 286—289).—Ppts. of this type can be produced in solutions of alkali phosphates, borates, zincates, aluminates, plumbites, and polysulphides in addition to those already known. Four types of growth are distinguished and discussed. L. S. T.

Colloidal structure of bitumens.—See B., 1942, I, 219.

Mixed solvents for soaps.—See A., 1942, I, 202.

Electrochemical properties of mineral membranes. III. Estimation of ammonium ion activities. IV. Measurement of ammonium ion activities in colloidal clays. C. E. Marshall and W. E. Bergman (*J. Physical Chem.*, 1942, **46**, 325—327, 327—334).—III. Using electrodialysed bentonite membranes dried at 490° the potentiometric determination of $NH_4^·$ activities has been carried out. Above p_H 4 agreement between observed and calc. vals. is good. The effect of $Ca^{··}$ is more marked than with $K^·$–$Ca^{··}$ mixtures.

IV. Titration curves with aq. NH_3 have been obtained for the same four clays as were investigated in connexion with $K^·$ (cf. A., 1942, I, 172). NH_4 salts of weak acids or of high initial p_H lose $NH_4^·$ to the clay in much the same way as does NH_3. C. R. H.

Statistical thermodynamics of rubber. F. T. Wall (*J. Chem. Physics*, 1942, **10**, 132—134).—The change in entropy for the stretching of rubber has been calc. by statistical methods, neglecting intermol. attractions and deformation of bonds and bond angles, and an equation of state relating tension, length, and temp. of a rubber band has been derived. W. R. A.

Interaction between rubber and liquids. I. Thermodynamical study of system rubber–benzene. G. Gee and L. R. G. Treloar (*Trans. Faraday Soc.*, 1942, **38**, 147—165).—Equations relating thermodynamic properties of a rubber–liquid system to its v.p. are developed. V.p. of rubber–C_6H_6 mixtures at 25° have been measured, the use of four different methods (osmotic pressure, equilibration against triolein, direct manometric, and McLeod gauge) enabling the range 2×10^{-6}—0·997 wt. fraction to be covered. Temp. coeffs. of the v.p. are given for a no. of concns. From the data the Gibbs free energies, heats, and entropies of dilution and of dissolution are calc. The entropy of dilution ΔS_0 is approx. twice the heat of dilution over a wide range of concn. and is independent of the mol. wt. of the rubber fraction except in dil. (<5%) solutions. ΔS_0 is ⩾ the ideal val. and can be represented approx. by Flory's equation (cf. A., 1942, I, 58) at concns. >5%. The miscibility of rubber and C_6H_6 can be explained only by the abnormally high entropy of dissolution. F. L. U.

Micellar or macromolecular mode of reaction of cellulose xanthate.—See B., 1942, II, 151.

VI.—KINETIC THEORY. THERMODYNAMICS.

Mechanism of aromatic side-chain reactions with special reference to the polar effects of substituents. XI. The aldehyde–cyanohydrin reaction : evidence for the mesomeric effects of alkyl groups. J. W. Baker and M. L. Hemming (*J.C.S.*, 1942, 191—198; cf. A., 1940, I, 295).—The equilibrium consts. at 20° and 35° and the velocity consts. at 20° for the reaction p-C_6H_4R·CHO + HCN ⇌ p-C_6H_4R·CH(OH)·CN have been determined where R = H, Me, Et, Pr^β, or Bu^γ. These indicate that the stability of the free aldehyde relative to the cyanohydrin and hence the relative total electron-release effect increases in the order H < Bu^γ < Pr^β < Et < Me. Since this is known to be the order of inductive electron-release (cf. A., 1940, I, 391) the new results indicate the same sequence for the mesomeric electron-release effect in agreement with Baker and Nathan's hypothesis (cf. A., 1936, 195). W. C. J. R.

Complex formation associated with distribution of ferric chloride between water and ether.—See A., 1942, I, 202.

Spectroscopic investigation of the association of normal primary alcohols. J. Kreuzer and R. Mecke (*Z. physikal. Chem.*, 1941, **B**, **49**, 309—323).—A new photo-electric spectrophotometer is described. The absorption of the sharp band (λ 9680) of MeOH, EtOH, Pr^nOH, and Bu^nOH in CCl_4 has been investigated up to concns. of 0·01 g.-mol. per l. The law governing the association of PhOH, $K = ac/(1 - \sqrt{a})$, holds also for the alcohols, although the latter, apparently on account of their polar association, show systematic deviations. The form of the absorption curve for low concns. is discussed. The binary complex appears to be absent at low concns. A. J. M.

Quantitative investigation of amino-acids and peptides. VII. Equilibria between amino-acids and formaldehyde. E. H. Frieden, M. S. Dunn, and C. D. Coryell (*J. Physical Chem.*, 1942, **46**, 215—221).—The polarimetric titration method used for determining the consts. of the *l*-proline–CH_2O equilibria is based on the principle that the optical rotations of any complexes which may be formed

will differ from each other and from that of *l*-proline. The only complex observed has a val. 105±5 for its association const. C. R. H.

Light absorption of nickel thiocyanate solutions. A. von Kiss and P. Csokán (*Z. anorg. Chem.*, 1941, **245**, 355—364).—Extinction curves of $Ni(CNS)_2$ solutions containing KCNS and other salts show the existence of the complex ions $[Ni(H_2O)_5CNS]^+$ and $[Ni(CNS)_4]''$ in solutions containing a large excess of $Ni^{••}$ and CNS' respectively. Conc. solutions of $Ni(CNS)_2$ contain the undissociated salt. Solutions of $NiCl_2$ in conc. HCl and of $NiSO_4$ in conc. H_2SO_4 contain the complex ions $[NiCl_4]''$ and $[Ni(SO_4)_3]''''$, respectively. C. R. H.

Diffusibility and hydrolysis of yttrium and cerous salts in aqueous solutions of different hydrogen-ion concentration. G. Jander and H. Möhr (*Z. physikal. Chem.*, 1941, **A, 189**, 335—343).—The diffusion coeff. (*D*) of $Y^{•••}$ and $Ce^{•••}$ in 0·04M-$Y(NO_3)_3$ and -$Ce(ClO_4)_3$ remains const. whether the solution is made M. in the respective acids or in the respective Na salts. *D* for $Y^{•••}$ also remains unchanged when the solution containing $NaNO_3$ is made 0·04 or 0·08M. in NaOH, whilst *D* for $Ce^{•••}$ in the presence of $NaClO_4$ is unaltered when the solution is made 0·04M. in NaOH. The results are interpreted as indicating that, unlike Al^{III}, Fe^{III}, and Cr^{III} salts, there is no tendency to form O-bridged basic ions, but a proportional amount of the $Y^{•••}$ or $Ce^{•••}$ is pptd. as hydroxide. J. W. S.

Resumé of the proton transfer concept of acids and bases. H. N. Alyea (*J. Chem. Educ.*, 1941, **18**, 206—209). L. S. T.

Effect of substituents on the acid strength of benzoic acid. V. In *n*-propyl alcohol. J. H. Elliott (*J. Physical Chem.*, 1942, **46**, 221—227).—The acid strengths (*K*) of 23 monosubstituted benzoic acids in Pr^nOH have been potentiometrically determined. Log *K* varies linearly with $1/\epsilon$ (ϵ = dielectric const.) for the substituents *o*-Br, -Cl, -OMe, *m*- and *p*-Me as was observed in Bu^nOH (cf. A., 1941, I, 210). In the other cases disagreement is pronounced. The cases where agreement is observed are considered exceptional. Where ϵ for the solvent is <24·2 the relation is generally not linear. C. R. H.

Relative acidity and basicity of sulphanilamide and *p*-aminobenzoic acid. A. Albert and R. Goldacre (*Nature*, 1942, **149**, 245).—*K* (base) and *K* (acid), respectively, have been determined as follows: sulphanilamide (**I**), $1·6 \times 10^{-12}$, $6·3 \times 10^{-11}$; *p*-$NH_2·C_6H_4·CO_2H$ (**II**), $3·1 \times 10^{-12}$, $1·5 \times 10^{-5}$; *p*-$NH_2·C_6H_4·CH_2·CO_2H$ (**III**), $3·1 \times 10^{-11}$, $6·3 \times 10^{-6}$. The fact that (**I**) and (**II**) are bases of approx. the same strength, together with a certain steric similarity between (**I**) and (**II**), support Fildes' hypothesis that (**I**) acts biologically by competing against the essential metabolite, (**II**), for the possession of particular groups (receptors) in enzyme systems. The feeble basicity may be connected with the formation of NH·OH-compounds. (**III**), a much stronger base, possesses no anti-(**I**) activity. A. A. E.

Statistical mechanics of binary systems. K. Fuchs (*Proc. Roy. Soc.*, 1942, **A, 179**, 340—361).—The partition function of a binary solid solution is derived as an expansion in powers of the at. fractional concn. Singularities in the expansion correspond to a phase transition. The case of a binary solid solution with a two-phase field is treated in full; limits of solid solubility and the sp. heat are obtained. The latter is discontinuous at the phase boundary. G. D. P.

Compounds of magnesium with elements of the IVb group. W. Klemm and H. Westlinning (*Z. anorg. Chem.*, 1941, **245**, 365—380).—The phase diagram of the system Mg–Ge has two eutectics, at 635° (1·2—1·3 at.-% of Ge) and at 690° (~60 at.-% of Ge), and a peak at 1115±5°, the m.p. of Mg_2Ge. The lattice consts. of Mg_2Ge, Mg_2Si, Mg_2Sn, and Mg_2Pb have been redetermined, viz., 6·380, 6·338, 6·762, and 6·799±0·002 A., respectively. Comparison between the phase diagrams of these four Mg–metal systems, especially in the Mg-rich region, has been made. The solubility of Si and Ge in solid Mg is <0·1 at.-% at 600°. C. R. H.

Transformations of H_2Se–HDSe–D_2Se mixed crystals. A. Kruis (*Z. physikal. Chem.*, 1941, **B, 48**, 321—335).—Calorimetric studies of the mixed crystals of the ternary system H_2Se–HDSe–D_2Se have shown that the displacement of the transformation temp. and melting temp. in the transition of H_2Se to D_2Se is $\propto$ the D content of the mixed crystals and that the sharpness of the transformation and m.p. is approx. the same as in the pure components H_2Se and D_2Se. Transformation temp. for HDSe have been interpolated. W. R. A.

Geometric interpretation of the method of intercepts. H. S. van Klooster (*J. Chem. Educ.*, 1941, **18**, 283—284). L. S. T.

Heats of combustion of aliphatic and polymethylenic hydrocarbons in relation to their structure. V. P. Golmov (*J. Gen. Chem. Russ.*, 1941, **11**, 405—410).—Correlation of the heat of combustion of the simpler aliphatic hydrocarbons with their structure shows that the H atoms contained therein are not thermochemically equiv.; the heat of combustion of H bound to C rises in the series $CH_4 < \cdot CH_3 < :CH_2 < \vdots CH$, thus explaining the higher reactivity of H attached to a *tert.* C. From the heats of combustion of cyclic polymethylenic hydrocarbons, it is shown that the energy stored in the ring structure is greatest for the 3- and 4-membered rings. N. G.

Heats of reaction of acid and alkaline phenol–formaldehyde mixtures.—See B., 1942, II, 164.

Second law of thermodynamics. R. H. Wright (*J. Chem. Educ.*, 1941, **18**, 263—269).—A semi-historical exposition. L. S. T.

Space model of the Carnot cycle. E. W. Kanning and R. J. Hartman (*J. Chem. Educ.*, 1941, **18**, 180—181).—A model, made in plaster of Paris set on a wooden base, is used to illustrate the four steps of a Carnot cycle. L. S. T.

Entropy increase accompanying the formation of azeotropic mixtures. A. K. Shdanov (*J. Gen. Chem. Russ.*, 1941, **11**, 483—492).—From the vals. of thermal expansion, heat of evaporation, and heat capacity of the azeotropic mixtures of Pr^nOH with C_6H_6 and PhMe and of Bu^BOH with CCl_4 and PhMe the change of entropy taking place in the formation of the mixture is calc. This change consists of a term common to all mixtures and another connected with the interaction of the components of the mixture. The second term is the greater the smaller is the difference between the b.p. of the azeotrope and that of an ideal mixture. J. J. B.

Statistical thermodynamics of rubber.—See A., 1942, I, 204.

Thermodynamical study of system rubber–benzene.—See A., 1942, I, 204.

VII.—ELECTROCHEMISTRY.

Conductance and ionic mobilities for aqueous solutions of potassium and sodium chloride at temperatures from 15° to 45°. H. E. Gunning and A. R. Gordon (*J. Chem. Physics*, 1942, **10**, 126—131).—Vals. of Λ for aq. NaCl and KCl (0·0005—0·01N.) at 10° intervals between 15° and 45° have been measured by a modified d.c. method and agree with a.c. vals. for 15° and 25°. Vals. can be represented at all temp. by the Onsager–Shedlovsky equation. Ionic mobilities and their temp. coeffs. are tabulated. W. R. A.

Chemistry of free thiocyanogen. Electric conductivity of the system thiocyanogen–organic solvent. J. A. Fialkov and K. E. Kleiner (*J. Gen. Chem. Russ.*, 1941, **11**, 671—682).—Solutions of $(CNS)_2$ in CS_2, CCl_4, $CHCl_3$, $CHBr_3$, EtBr, and Et_2O do not conduct electricity. If to a solution of $(CNS)_2$ in EtBr > 0·2 mol. of $COMe_2$ per 1 mol. of EtBr is added, the conductivity κ of the solution gradually increases and reaches a const. val. within 30 min.; a few hr. later κ decreases slightly. When κ has its max. val., the concn. of $(CNS)_2$ is ~10% of the initial concn., and it drops to <4% within a few hr. The increase of κ is probably due to the reaction $(CNS)_2 + COMe_2 = MeCO·CH_2·CNS + HCNS$ as the solution contains CNS'. The subsequent lowering of κ is probably due to polymerisation of $(CNS)_2$. J. J. B.

Variation of the transference numbers of sodium chloride in aqueous solution with temperature. II. R. W. Allgood and A. R. Gordon (*J. Chem. Physics*, 1942, **10**, 124—126; cf. A., 1940, I, 324).—The transference nos. of aq. NaCl (0·015—0·1N.) have been measured at 10° intervals from 15° to 45° by the moving boundary method. The Longsworth function $t_+^{0'}$ is linear at low concn. for all temp. and the val. at infinite dilution has been extrapolated. At higher concn. $t_+^{0'}$ deviates from linearity. Ionic mobilities for the various temp. have been evaluated. W. R. A.

Mobility of quinine ions. Permeability of Cellophane. E. B. R. Prideaux (*Trans. Faraday Soc.*, 1942, **38**, 121—128).—Comparison of collodion and Cellophane (**I**) membranes shows that whilst the former exerts a selective retardation on anions, even in salts of alkaloids, the membrane potentials of HCl and KCl obtained with (**I**) are nearly the same as the free diffusion potentials. This is also true of the potentials between solutions of quinine hydrochloride having concn. ratios 1/50, 1/20, and 1/10, the max. concn. being 0·1M. The transport no. of the anion is calc. to be 0·76, and the average mobility of the mixed uni- and bi-valent quinine cations is 21·5. At the concns. used the bivalent ion does not move with twice the speed of the univalent. The mobility of the univalent cation calc. for limiting dilution from conductivity data is 19 at 25°. F. L. U.

Accidental increase in the equivalent capacity of the conducting area between a Beilby layer and an electrolyte with solutions of alkali-metal iodides. F. J. Taboury (*Compt. rend.*, 1941, **213**, 62—64; cf. A., 1938, I, 461; 1939, I, 267).—The capacity of polished metal electrodes immersed in solutions of iodides of alkali metals is considerably > when they are immersed in solutions of chlorides, bromides, or oxy-salts. The Beilby layer remains unaltered, and with Pt, simple washing with H_2O sufficed to restore the electrode to normal when immersed in a chloride solution, after having given the abnormal results in an iodide. The origin of the phenomenon appears to be the presence of complex ions in the solution. A. J. M.

VIII.—REACTIONS.

Effect of concentration on reaction rate and equilibrium. A. A. Frost (*J. Chem. Educ.*, 1941, **18**, 272—274).—The validity of the law of mass action is discussed, and general derivation of the condition for equilibrium presented. L. S. T.

Kinetics of the interaction between dry sulphur dioxide and nitrogen dioxide. G. K. Boreskov and V. V. Illarionov (*J. Phys. Chem. Russ.*, 1940, **14**, 1428—1446).—The gas pressure of SO_2–NO_2 mixtures was measured at room temp. (p_1) before the reaction started, at high temp. after the equilibrium was reached (p_2), and after cooling the equilibrium mixture to the room temp. (p_3). The difference $p_2 - p_3$ corr. for the temp. difference gave the v.p. of the reaction product at the reaction temp.; it was 21 mm. Hg at 208° and 46 mm. at 231·5°. The difference $p_1 - p_3$ gave the composition of the reaction product as $(SO_2)_2N_2O_3$; direct analysis confirmed this. The decrease of pressure p at const. temp. $dp/dt \propto [SO_2][NO_2]$, but the kinetics above 208° are complicated by the dissociation of NO_2. The energy of activation between 160° and 230° is 24,500 g.-cal. and much less below 150°. At 208° the reaction is accelerated by glass wool if some H_2O is present. Probably the low activation energy below 150° is due to the heterogeneous reaction at the walls of the vessel (glass). Earlier results (cf. Zeiberlich, B., 1937, 131, and Kuzminich, A., 1937, I, 521) gave reaction coeffs. which were 10^3 times as high as the new ones. J. J. B.

Regions of inflammation of hydrocarbons. G. Reutenauer (*Compt. rend.*, 1941, **213**, 72—74).—The variations in the lower and upper temp. limits for the primary ignition of hexadecene, dipentene, and decahydronaphthalene have been investigated. The variation in ignition temp. with concn. has been determined. It varies considerably with the hydrocarbon, and this is probably due to the different intermediate compounds formed. A. J. M.

Aërated burner flames.—See B., 1942, I, 218.

Chain length and chain-ending processes in acetaldehyde decomposition. M. Burton, H. A. Taylor, and T. W. Davis (*J. Chem. Physics*, 1942, **10**, 146).—Erratum (A., 1940, I, 120). W. R. A.

Thermal decomposition of *n*-butylamine. H. C. Beachell and H. A. Taylor (*J. Chem. Physics*, 1942, **10**, 106—110).—NH_2Bu^{α} decomposes similarly to lower aliphatic amines and does not split up into NH_3 and C_3H_4 (cf. A., 1938, II, 425). Initially H atoms and a NHBu radical (I) are formed; (I) yields NH_3 through prior formation of an imine. Rates of pressure change yield an energy of activation of 89 kg.-cal. W. R. A.

Kinetics of reaction between manganous and permanganate ions. F. C. Tompkins (*Trans. Faraday Soc.*, 1942, **38**, 131—139).—The course of the reaction $3Mn^{\cdot\cdot} + 2MnO_4' + 2H_2O = 5MnO_2 + 4H^{\cdot}$ has been followed with the photo-electric turbidimeter (A., 1942, I, 214). The reaction is accelerated by increase in [$Mn^{\cdot\cdot}$] or [MnO_4'] and retarded by increase in [$H^{\cdot}$]. The presence of complex-forming anions (SO_4'', F') retards the formation of MnO_2. The initial presence of MnO_2 in the form of a sol leads to an increased rate of production of MnO_2, and is considered to catalyse the surface reaction $Mn^{\cdot\cdot\cdot\cdot} + 4OH' \rightarrow MnO_2 + 2H_2O$; this effect is much reduced if the MnO_2 is in a granular or coagulated condition, as well as in the presence of a protective such as gum arabic. The kinetics of the reaction are discussed and a mechanism is proposed. F. L. U.

Kinetics of the reaction between ethylene chlorohydrin and sodium hydroxide. D. Porret (*Helv. Chim. Acta*, 1941, **24**, 80—85E).—In accord with previous observations the reaction between $Cl{\cdot}[CH_2]_2{\cdot}OH$ and NaOH is approx. of second order and NaCl has only a very slight influence on its velocity. The energy of activation between 0° and 30° is 22,600 g.-cal. per g.-mol. The observed velocity of reaction is ~1000 times that predicted by the kinetic theory. J. W. S.

Reaction between glucose and iodine in alkaline medium. Effect of neutral salts. K. D. Jain and B. L. Vaish (*J. Indian Chem. Soc.*, 1941, **18**, 503—504).—KCl, KBr, KNO_3, NaCl, NaBr, $NaNO_3$, NH_4Cl, NH_4Br, and NH_4NO_3 retard the velocity of oxidation of glucose by I and the velocity coeff. of the reaction decreases with increasing concn. of the salts; k is not independent of the salt used. F. R. G.

Formation of chymotrypsin from chymotrypsinogen.—See A., 1942, III, 342.

Effect of moisture on chemical reactions. G. Chamlin (*J. Chem. Educ.*, 1941, **18**, 386—388).—A review. L. S. T.

Kinetics of ammonia synthesis on promoted iron catalysts. M. Temkin and V. Pishev (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 327—356).—Observed results for the kinetics of NH_3 synthesis may be accounted for if equations taking account of non-uniformity of surface and of interaction between adsorbed mols. are used to represent adsorption equilibria. The determining rate is that of activated adsorption of N_2; the apparent activation energy of the synthesis is ~14,000 g.-cal., and that of the dissociation ~40,000 g.-cal. F. J. G.

Catalytic properties of rhenium. VIII. Dehydrogenation of *iso*-amyl alcohol. IX. Dehydrogenation of alcohols by rhenium disulphide. M. S. Platonov (*J. Gen. Chem. Russ.*, 1941, **11**, 590—591, 683—685).—VIII. When *iso*-$C_5H_{11}{\cdot}OH$ is passed over Re at 250—500°, aldehydes, H_2, CO, and saturated and unsaturated hydrocarbons are formed; the yield of aldehydes and H_2 is max. at 400°, and the yield of other products is the higher the higher is the temp.

IX. ReS_2 is a powerful catalyst, giving with MeOH, EtOH, and $Pr^{\beta}OH$ H_2 and CH_2O, MeCHO, and $COMe_2$, respectively, whilst the formation of CO and hydrocarbons is negligible within the temp. range investigated (200—550°). *cyclo*Hexanol at 200—250° is transformed into roughly equal amounts of *cyclo*hexanone (I) and PhOH, but the yield of PhOH increases and that of (I) decreases at higher temp. (400—550°). J. J. B.

Peculiarities in the behaviour of the lead accumulator. Overvoltage and production of ozone at the positive electrode at the end of the charge at low temperature. E. Briner and A. Yalda (*Helv. Chim. Acta*, 1941, **24**, 109—118E).—For an accumulator containing H_2SO_4 of d 1·29 the p.d. across the terminals at the end of the period of charge, while gassing is in progress, increases from 2·36 v. at 19° to 2·82 v. at −43°, whereas the normal e.m.f. of the accumulator decreases with decreasing temp. At low temp. and high c.d. the O_2 produced at the anode contains O_3. The presence of O_3 in O_2 circulated around a Pb electrode in H_2SO_4 increases its potential considerably, particularly at low temp., but it has no effect on the potential of a PbO_2 electrode around which the O_2 is circulated. This behaviour is correlated with the fact that the potential of the $Pt,O_2,O_3|H_2SO_4$ electrode is < that of the $PbO_2|H_2SO_4$ electrode, and the higher potential observed during the evolution of gas is attributed to the production of O atoms. J. W. S.

Electrolysis of diethylacetic acid in mixture with its alkali metal salts and with the addition of nitrates. F. Fichter and M. Rudin (*Helv. Chim. Acta*, 1941, **24**, 398—405E).—Electrolysis of $CHEt_2{\cdot}CO_2H$ (I) (5 mols. per l.) to which KOH (2 mols. per l.) has been added yields principally $CHEt_2{\cdot}OH$, $CHMePr^{\alpha}{\cdot}OH$, and the esters formed by their interaction with (I), together with $CHMe{\cdot}CHEt$, $COEt_2$, and $COMePr^{\alpha}$. Only very low yields of $(CHEt_2)_2$ are obtained. The esters are very stable and can be hydrolysed in aq. solution only with difficulty. The electrolysis of (I) in the presence of alkyl nitrates or $(CH_2{\cdot}O{\cdot}NO_2)_2$ yields, in addition to the above, also $CHEt_2{\cdot}O{\cdot}NO_2$, $CHMePr^{\alpha}{\cdot}O{\cdot}NO_2$, and the various esters formed by $OH{\cdot}CHMe{\cdot}CHEt{\cdot}OH$ with (I) and HNO_3. J. W. S.

Relation of electromotive force to the concentration of deuterium oxide in saturated standard [cadmium] cells.—See A., 1942, I, 175.

Cathodic protection of steel in corrosive solutions.—See B., 1942, I, 240.

Electrolytic polishing [of metals].—See B., 1942, I, 242.

Mechanism of chemical reactions in the glow discharge. A. Schechter (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 357—370).—Current theories of the mechanism of chemical reactions in the glow discharge are discussed. Reasons are given for the belief that the active centres are not ions or excited mols., but atoms, and that combination occurs in an adsorbed layer on the walls. F. J. G.

Inhibition of photochemical and dark reactions by inorganic compounds. S. S. Greenfield (*Science*, 1941, **93**, 550—551).—$ZnSO_4$, $NiSO_4$, KCl, and solutions of high osmotic pressure retard the dark reaction. $CuSO_4$, H_2BO_3, KI, $CoSO_4$, and $(NH_4)_2SO_4$ retard both dark and photochemical reactions. E. R. R.

Chlorknallgas. II. Rôle of the reaction $H + HCl = H_2 + Cl$. M. Bodenstein [with L. von Müffling, A. Sommer, and S. Khodschaian]. **III. Chain breaking in oxygen-containing gases.** M. Bodenstein and H. F. Launer (*Z. physikal. Chem.*, 1941, **B**, **48**, 239—267, 268—288).—II. The explanations advanced by Ritchie and Norrish (A., 1933, 576) are erroneous. The reaction involving the breaking up of HCl is insignificant and the velocity ∝ light intensity. The velocity of the reaction $H + HCl = H_2 + Cl$ has been compared with that of the reaction $H + Cl_2 = HCl + H$ using p-H_2 and the ratios are 1 : 249 at 30°, 1 : 114 at 110°, and 1 : 57 at 198°.

III. Kinetics of explosions in mixtures containing various amounts of H_2, Cl_2, HCl, with addition of O_2, have been investigated. Chain breaking occurs through $H + O_2 + M = HO_2 + M$, Cl and the wall, and $Cl + O_2 + HCl = H_2O + Cl_2$. The HO_2 reacts with H_2 and with HCl to give H_2O_2 and with Cl_2 to give ClO_2 and these are converted into stable end products by Cl and H. Existing data are discussed. W. R. A.

Photo-oxidation of iodide ion sensitised by eosin. Effect of oxygen concentration and of light intensity. R. Livingston (*J. Physical Chem.*, 1942, **48**, 233—238).—At relatively low light intensities (I) the quantum yield (ϕ) can be represented by $\phi = A[O_2]^{0\cdot5}/I^{0\cdot5}$ (A = const.). Yields as high as 2·8 have been observed but this

may not be the max. attainable. The data are compared with earlier data (cf. A., 1941, I, 275). C. R. H.

Photolysis of azomethane in the presence of hydrogen. H. A. Taylor and R. G. Flowers (*J. Chem. Physics*, 1942, **10**, 110—115).—Between 20° and 200° the C_2H_6 produced in the photolysis of azomethane in presence of H_2 is independent of H_2 and at low temp. the amount of CH_4 produced is decreased. The rate increases more rapidly with temp. if H_2 is present. A mechanism, involving CH_3 radicals is proposed; CH_4 is produced by the reaction $CH_3 + CH_3 = 2CH_4$. This is preferred to $CH_3 + H_2 = CH_4 + H$ because no H atoms could be detected. A similar mechanism has been advanced to account for the decomp. of $HgMe_2$. W. R. A.

p_H changes in water when irradiated with *X*-rays. P. Günther and L. Holzapfel (*Z. physikal. Chem.*, 1941, **B**, **49**, 303—308).—The observation of Risse (A., 1930, 1261) that there is a decrease in the p_H of H_2O when irradiated with *X*-rays has been shown to be due to the presence of an impurity, probably H_2CO_3. This probably gives rise to a stronger acid (possibly $H_2C_2O_4$) when irradiated with *X*-rays. The effect is not observed with ordinary impure H_2O on account of its buffering action. A. J. M.

Mechanism of oxidation effect of ultrasonic vibrations. S. Bresler (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 323—326).—With the aid of "luminol" (3-aminophthalhydrazide) as an indicator of the presence of oxidising radicals, it has been shown that the formation of H_2O_2 by ultrasonic vibrations in H_2O depends on activation of dissolved O_2, and that this is connected with cavitation. F. J. G.

IX.—METHODS OF PREPARATION.

Sodium monothio-orthophosphate. E. Zintl and A. Bertram (*Z. anorg. Chem.*, 1940, **245**, 16—19).—*Anhyd. Na monothio-orthophosphate*, Na_3PO_3S, is obtained when the calc. quantities of $NaPO_3$ and Na_2S are heated at 450—750°. It exists in two modifications with a transition temp. at ~550°. On crystallisation from H_2O it affords the dodecahydrate, which is identical with that obtained by hydrolysis of $PSCl_3$. F. J. G.

Existence of anhydrous sodium silicophosphates. E. Zintl and W. Morawietz (*Z. anorg. Chem.*, 1940, **245**, 12—15).—The products resulting from the ignition of Na phosphates at > 1100° with Na_2SiO_3 or SiO_2 have been studied. No evidence for the existence of $Na_3[Si(PO_4)_4]$ (A., 1929, 39) was obtained. SiO_2 does not displace P_2O_5 from Na phosphates but $NaPO_3$ and Na_2SiO_3 afford Na_3PO_4 and SiO_2. A high-temp. *modification* of Na_3PO_4 exists. The transition temp. is ~700°. F. J. G.

Action of ozone on sputtered metals. H. Schütza and I. Schütza (*Z. anorg. Chem.*, 1940, **245**, 59—66).—When Au is sputtered by high-frequency sparking in an O_2–O_2 mixture, the product contains 40% of Au_2O_3, and when heated evolves ~2% of O_2. With Pb the product consists mainly of PbO_2 and evolves ~4% of O_2 when heated. The O_2 may be adsorbed, or may originate in the decomp. of a higher oxide. Pure Au_2O_3 and PbO_2 do not evolve O_2 when heated; earlier observations suggesting that they do so are due to the liberation of N oxides from specimens contaminated with NO_3' from the method of prep. F. J. G.

Structure of tricalcium aluminate.—See A., 1942, I, 166.

Tensimetric determination of higher ammoniates of complex salts. II. G. Spacu and P. Voichescu (*Z. anorg. Chem.*, 1941, **245**, 341—351).—The composition of complex metal ammines of the general type $[XY]Cl_2,nNH_3$, where X = Cd, Zn, Co, and Ni, Y = benzidine (**I**), *o*-tolidine (**II**), and *o*-dianisidine (**III**), and n is a whole no. has been determined. For the same central metal the heat of formation (Q) decreases with increase in n, and for a given val. of n, Q increases as the at. vol. of the central metal decreases. Cd and Zn compounds with $n = 5$ are not formed and Zn compounds with (**I**) and (**III**) are the only compounds with $n = 7$. Unlike (**II**) which forms complexes with n > 10, (**I**) and (**III**) form complexes with $n = 12$. The prep. and properties of the (**III**) complexes, here reported for the first time, are described. C. R. H.

Transformation of black mercuric sulphide into red by heating. J. Krustinsons (*Z. anorg. Chem.*, 1941, **245**, 352—354).—The rate of conversion of black HgS into red increases with temp., attaining a max. at ~290°. Above this temp. there is a decrease in conversion with decomp. of HgS into Hg and S. The change is apparently catalysed by $Hg_2Cl_2S_2$ or Hg_3Cl_2 formed together with HgS when H_2S is passed through a solution of $HgCl_2$. C. R. H.

Boron monoxide. E. Zintl, W. Morawietz, and E. Gastinger (*Z. anorg. Chem.*, 1940, **245**, 8—11).—*BO* is obtained as a light brown sublimate when B is heated with ZrO_2 at 1800° in vac. F. J. G.

Double oxides having the rock-salt structure. E. Zintl and W. Morawietz (*Z. anorg. Chem.*, 1940, **245**, 26—31).—Na_2PrO_3, in which Pr is quadrivalent, is obtained by heating Pr_2O_3 with Na_2O at 470° in O_2. It has the rock-salt structure with a 4·84 A., and ρ 4·60. The Na and Pr^{IV} cations are distributed statistically over equiv. positions. Na_2CeO_3 has an analogous structure, with $a = 4{\cdot}82$ A. When La_2O_3 and Na_2O are heated in O_2 at 500° the product is $NaLaO_2$. F. J. G.

Formation and stability of halogen and cyanogen derivatives of the carbonyls and carboxycyanides. I. B. Ormont (*Acta Physicochim. U.R.S.S.*, 1940, **12**, 411—432).—The possibility of the existence of various types of CN–carbonyl compounds of the transitional metals is discussed. Theoretical considerations indicate that in $Fe(CO)_4Cl_2$ the Cl atoms are covalently, not ionically, bound and that $Fe(CO)_4(CN)_2$ should be very stable. F. J. G.

Silicon monoxide. E. Zintl [with W. Bräuning, H. L. Grube, W. Krings, and W. Morawietz] (*Z. anorg. Chem.*, 1940, **245**, 1—7).—SiO_2 is quantitatively volatilised as SiO when silicates are heated with the calc. quantity of Si at ~1500° in vac. The sublimate may be solid SiO or may be a mixture of Si and SiO_2. It is readily oxidised to SiO_2, by air at room temp., by H_2O or CO_2 at 500°, and by SO_2 at 800°. Cl_2 at 800° affords $SiCl_4$ and SiO_2. When it is heated in vac. at 1350° with CaO and MgO or ZnO, Mg or Zn volatilises and Ca_2SiO_4 remains. F. J. G.

Thiohalides of metalloids. Preparation and properties of phosphorus thiofluoride. S. A. Voznesenski and L. M. Dubnikov (*J. Gen. Chem. Russ.*, 1941, **11**, 507—517).—PSF_3 was prepared from P_2S_5 and $3PbF_2$ and purified by pumping off at −85°. It has m.p. −121°, b.p. −57·5°/740, v.p. 0·2 atm./−100° and 5·0 atm./−12·2°; mol. wt. 118—121. The hydrolysis by H_2O vapour at 21° is very slow (weeks). Na (and K) at 200° produce ignition and give NaF, Na_2S, S, and P_2O_3. Fe reacts similarly. Hot $KMnO_4$ gives PF_3. $NHEt_2$ gives $PSF(NEt_2)_2$, m.p. 54·4°, ρ 1·06, and $PSF_2{\cdot}NEt_2$, crystals (from C_6H_6). J. J. B.

Sodium bismuthate. E. Zintl and K. Scheiner (*Z. anorg. Chem.*, 1940, **245**, 32—34).—When Bi_2O_3 is heated at 650° in O_2 with Na_2O or Na_2O_2, in proportions Na : Bi = 3—4, the product contains 100% of Bi^V and is free from Na_2O_2. This suggests the existence of Na_3BiO_4 and also of a *bismuthate* richer in alkali. With Na : Bi < 3, the product contains Bi^{III} and Na_2O_2, and with Na : Bi > 4 Na_2O_2 is formed in addition to bismuthate. F. J. G.

Action of hydrogen sulphide on sulphites. III. Influence of hydrogen-ion concentration on the direction of the reaction. J. I. Zilberman and V. M. Fridman (*J. Gen. Chem. Russ.*, 1941, **11**, 363—370; cf. A., 1941, **I**, 19, 344).—The variation of the yields of $Na_2S_2O_3$ and Na polythionates formed by interaction of H_2S with Na sulphite–bisulphite solutions is shown graphically for p_H vals. 5·06—7·26. At 80°, the yield of S_2O_3'' is greatest at p_H 6·2, and falls rapidly in more acid or more alkaline media because of side reactions, during which polythionates are produced. At 20°, the yield of S_2O_3'' is greater, and varies much more slowly with p_H, being greatest at p_H 6·28—6·31. A glass electrode was used for p_H measurement. N. G.

Affinity. XCV. Uranium phosphides. M. Heimbrecht, M. Zumbusch, and W. Biltz (*Z. anorg. Chem.*, 1941, **245**, 391—401).—An investigation of the system U–P has shown the existence of UP_3, U_3P_4, and UP. The mol. vol. and structure of these compounds as revealed by *d* and *X*-ray data are discussed with reference to similar properties of U sulphides and Th phosphides, and the ionic vols. of P$'''$ and S$''$ in these compounds have been calc. C. R. H.

Sodium orthoperiodate. E. Zintl and W. Morawietz (*Z. anorg. Chem.*, 1940, **245**, 20—25).—NaI may be oxidised directly to Na_5IO_6 by heating in air at 400—700° with Na_2O, Na_2O_2, or NaOH, or by heating in absence of air with NaOH and $NaNO_3$. F. J. G.

Metallic carbonyls. XXXII. Iron carbonyl halides. W. Hieber and A. Wirsching (*Z. anorg. Chem.*, 1940, **245**, 35—58).—The reactions of a no. of halogen compounds with $Fe(CO)_5$ (**I**) or $Fe(CO)_4I_2$ (**II**) have been investigated. With (**I**), IBr and ICl afford $Fe(CO)_4IBr$ (**III**) and $Fe(CO)_4ICl$, and $SbCl_5$ and $SnCl_4$ afford $Fe(CO)_4SbCl_5$ (**IV**) and $Fe(CO)_4SnCl_4$ (**V**). (**IV**) and (**V**) contain Fe^{II} and Sb^{III} or Sn^{II} and are non-electrolytes. $SOCl_2$ reacts violently with (**I**), liberating CO and affording a *product* which contains Fe, CO, Cl, and S. $SOCl_2$ with (**II**) affords $Fe(CO)_2Cl_2$ (**VI**) ($\rho_4^0 = 2{\cdot}233$) liberating CO, I_2, and SO_2. Comparative data on the rates of thermal decomp. of these substances and of the other Fe carbonyl halides are given. (**IV**), (**V**), and (**VI**) are intermediate in stability between $Fe(CO)_5Cl_2$ and $Fe(CO)_4Br_2$, and (**III**) between $Fe(CO)_4Br_2$ and (**II**). F. J. G.

Nickel hydrides. A. A. Balandin, B. V. Erofeev, K. A. Petscherskaja, and M. S. Stachanova (*J. Gen. Chem. Russ.*, 1941, **11**, 577—589).—When $NiCl_2$ (distilled in HCl) reacts with MgPhBr in Et_2O, C_6H_6, or PhMe in a H_2 atm., 2—18 mols. of H_2 are absorbed for 1 mol. of $NiCl_2$. The low absorption is due to formation of NiH_2, and the high absorption to dissolution of H_2 in the Ni hydride suspension and, to a larger extent, to hydrogenation of the aromatic solvent or of the decomp. products of MgPhBr. The hydrogenated products have been isolated but not identified. When $NiCl_2$ reacts with Mg hexyl bromide in Et_2O or Bu^n_2O, the amount of H_2 absorbed is 3·7—4·7 mols. Thermal decomp. of Ni hydride from these solutions shows it to be NiH_4; earlier investigators found NiH_2

since they decomposed it by acids and induced hydrogenation of C_4H_6 by NiH_4. The rate v of absorption of H_2 by $NiCl_2$–MgPhBr solutions is poorly reproducible but usually shows a min. after 2·6 mols. of H_2, and a max. after 3—3·5 mols., have been absorbed. In some cases v had a min. at the absorption of 1 H indicating a hydride NiH. The composition of the stable hydride (NiH_4) is independent of temp. (18—50°) but v is lower at higher temp. If v is high, the total amount of H_2 absorbed is also high. As formation of NiH_4 can take place without hydrogenation but no hydrogenation occurs without formation of NiH_4, the hydrogenation appears to be more sensitive to poisons than is the synthesis of hydride. Thiophen stops the absorption of H_2 altogether. The NiH_4 formed in Et_2O remains in colloidal solution when [MgPhBr] is >0·5 mol. and ppts. when [MgPhBr] is <0·3 mol.; the excess of MgPhBr functions as a protective colloid. J. J. B.

Reactions in the solid state at high temperatures. XXV. Intermediate states arising in the formation of nickel aluminate from nickel oxide and aluminium oxide in the solid state. W. Jander and K. Grob (*Z. anorg. Chem.*, 1940, **245**, 67—84).—The properties of equimol. mixtures of NiO and α-Al_2O_3 after ignition at various temp. (500—1000°) have been studied. The rate of dissolution of Al_2O_3 remains const. for mixtures heated at ≯690°, then rises to a sharp max. for those heated at 750°, and then slowly falls. In powder photographs the first appearance of the lines of $NiAl_2O_4$ is in preps. heated at 1000°. When the preps. are used as catalysts for the decomp. of MeOH, H_2 and CO are the main products, and the yields of these are a max. for preps. ignited at 715°, with a lower max. at 850°. The yields of various minor products depend markedly and specifically on the ignition temp. F. J. G.

X.—ANALYSIS.

Qualitative spectrochemical analysis in agriculture and geochemistry. S. S. Ballard (*J. Appl. Physics*, 1940, **11**, 750—758).—The technique of the qual. or semi-quant. spectrographic analysis of soil, fertiliser, plant, and geological samples for trace elements is described. O. D. S.

Spectrochemical analysis for trace elements.—See A., 1942, I, 215.

Polarographic analysis. III. Fundamentals of quantitative analysis. IV. Fundamentals of qualitative analysis. V. Applications. O. H. Müller (*J. Chem. Educ.*, 1941, **18**, 172—177, 227—234, 320—329). L. S. T.

Adsorption analysis. A. Tiselius (*Science*, 1941, **94**, 145—146).—The Twsett method is modified and its application to the analysis of colourless substances discussed. E. R. R.

Optimum volume for a wash portion. L. Waldbauer and W. P. Cortelyou (*J. Chem. Educ.*, 1941, **18**, 341—342).—The best conditions for washing a ppt. are discussed mathematically. The general rule of washing with 10-c.c. portions of wash liquid is not sound; a better rule is to wash with vols. 2—4 times that of liquid retained by the pores of the ppt. and between the ppt. and the walls of the vessel. L. S. T.

Application of organic reagents to inorganic analysis. J. A. Southern (*J. Chem. Educ.*, 1941, **18**, 238—240).—General principles are discussed and illustrated. L. S. T.

Determination of total and inorganic bromide in foods fumigated with methyl bromide.—See B., 1942, III, 138.

Magnesium acetate as an ashing agent in fluorine analysis.—See A., 1942, III, 504.

Indirect polarographic determination of phosphorus in biological material.—See A., 1942, III, 504.

Determination of boron in soils.—See B., 1942, III, 126.

Micro-determination of calcium by precipitation as picrolonate and determination of the precipitated carbon by manometric combustion. D. D. Van Slyke and F. J. Kreysa (*J. Biol. Chem.*, 1942, **142**, 765—776).—The Ca is pptd. as picrolonate, the C of which after centrifuging and draining is determined by the manometric wet combustion method (A., 1941, II, 24). The method is accurate for ±0·2 mg. Ca. A. L.

Spectrographic analysis of magnesium alloys.—See B., 1942, I, 241.

Potentiometric measurements for the determination of complex ions in cadmium salt solutions.—See A., 1942, I, 174.

Adsorption by metals of the iron group in analysis. G. J. Austin (*Analyst*, 1942, **87**, 132—135).—Results of tests showing the effect of p_H on the co-pptn. of Ni, Fe, Zn, Cr, and Mn with Al are tabulated. In the determination of Al by Lundell and Knowles' method (A., 1923, ii, 341) in presence of Ni, much more Ni is co-pptd. than was anticipated. S. B.

Rapid detection of nickel in alloy steel.—See B., 1942, I, 239.

Photo-colorimetric determination of vanadium in iron.—See B., 1942, I, 237.

Determination and localisation of metallic minerals by the contact print method. G. Gutzeit (*Amer. Inst. Min. Met. Eng.*, 1942, **6**, *Tech. Publ.* 1457, 13 pp.).—Gelatin-coated paper is impregnated with a selective attacking reagent, such as a mineral acid, H_2SO_3, org. acids, NH_3, KCN, and NaOH, and then placed on a polished surface of the mineral or ore, and pressed in contact with it. The contact print is developed by treatment with a reagent, of the type used in drop reactions, which locates by colour the constituent sought. Photomicrographs are taken of the polished surface and print, and are superimposed to obtain accurate localisation. The method permits the determination and localisation of the different elements forming an opaque mineral without destruction of the surface, the estimation of relative amounts of an element, and the solution of mineralogical problems, such as the identification of the members of closely-related groups, and of metallurgical problems concerned with suitable concn. processes to be applied to an ore. Reagents suitable for detecting Sb, As, Bi, Cd, Cr, Co, Cu, Au, Fe, Pb, Mn, Hg, Mo, Ni, Pd, Ag, S, Sn, Ti, W, U, V, and Zn are enumerated, and coloured photomicrographs obtained with Cu–Pb, W, and Mn ores are reproduced. L. S. T.

XI.—APPARATUS ETC.

Resistor furnace, with some preliminary results [on the behaviour of refractory materials] up to 2000°. R. F. Geller (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 555—566).—The laboratory furnace described utilises healing elements of fused ThO_2 (85) with Y_2O_3 (15) moulded around Pt–Rh wires utilised for the preliminary heating of the oxides to the temp. at which they become freely conductive. Contact is made to the conductors through a mixture of ZrO_2 (85) with Y_2O_3 (15). An oxidising atm. can be maintained in such a furnace. Various linings have been used. It has been shown that shapes of the following pairs of oxides can be heated in contact to the temp. indicated without harmful effect; MgO–ThO_2, BeO–ThO_2, and ZrO_2–ThO_2 2000°, Al_2O_3–ThO_2 1850°, Al_2O_3–ZrO_2 1900°, BeO–ZrO_2 1925, MgO–BeO 1800°, Al_2O_3–BeO 1825°. The product of heating an intimate mixture of ZrO_2 + ThO_2 at ~2000° has anomalous thermal expansion, showing a large reversal between 500° and 1000°. This cannot be explained by compound formation since *X*-ray and petrographic examination shows only the presence of the original oxides. Spinel and chrysoberyl (m.p. 1855—1880°) are the principal products of heating MgO + Al_2O_3 and BeO + Al_2O_3 mixtures, respectively. J. W. S.

Physical tools in chemistry. D. H. Killeffer (*Rev. Sci. Instr.*, 1942, **13**, 49—53).—A brief review, including a diagram of a recording infra-red spectrometer and electron micrographs of MgO and $CaCO_3$. A. A. E.

Recording echelette grating spectrometer for the near infra-red. L. G. Smith (*Rev. Sci. Instr.*, 1942, **13**, 54—62).—The prism-grating spectrometer employs replica echelette gratings and is capable of resolving lines from 0·3 cm.$^{-1}$ to 1·0 cm.$^{-1}$ apart in the region 1—25 μ. Galvanometer deflexions can be directly recorded and atm. absorption has been almost entirely eliminated. A. A. E.

New source for infra-red spectrometers. L. G. Smith (*Rev. Sci. Instr.*, 1942, **13**, 63—64).—A C rod heated electrically in vac. provides a source of brightness comparable with that of a Nernst glower but more robust and of greater width. A. A. E.

Infra-red absorption cell for gases at high and low temperatures. L. G. Smith (*Rev. Sci. Instr.*, 1942, **13**, 65—67).—The cell, of Monel metal and sealed with rock-salt windows, may be used at temp. from −100° to 200°. A. A. E.

Anti-reflexion films on glass surfaces. A. F. Turner (*J. Appl. Physics*, 1941, **12**, 351—352).—A criticism of French (A., 1941, I, 91). In order to obtain max. transmission of visual white light the thickness of anti-reflexion cryolite films on glass should be adjusted to ±10% of the theoretical thickness for max. transmission in the green. O. D. S.

Improved source for the Lyman continuum in the vacuum ultraviolet. R. E. Worley (*Rev. Sci. Instr.*, 1942, **13**, 67—71).—Mechanical difficulties are largely avoided by use of a replaceable SiO_2 capillary held in permanent alignment by a metal clip, and a fin-type electrode that prevents clogging of the spectrograph slit. A. A. E.

Demonstrating ultramicroscope. H. J. Abrahams and W. Blitzstein (*J. Chem. Educ.*, 1941, **18**, 378—379).—Apparatus for demonstrating Brownian movement is described and illustrated. L. S. T.

New cassette for *X*-ray diffraction patterns. S. T. Gross (*Rev. Sci. Instr.*, 1942, **13**, 81—82).—The cassette, which is constructed in one piece and may be of Al, is designed to prevent bulging of the film which is inserted through a slot. A. A. E.

New method in *X*-ray crystallography. E. Orowan (*Nature*, 1942, **149**, 355—356).—The method described gives directly both spacings and positions of the reflecting planes for all diffraction spots in a rotation or oscillation photograph on flat film. A fine grid of thin

parallel wires is placed in front of the film and rotated in its own plane during the exposure, the rotation being linked with that of the crystal. The position of the reflecting planes in the crystal is given by the inclination of the lines, and their spacing by the position of the diffraction spots. A. A. E.

Compact calomel electrode. E. H. Shaw, jun. (*J. Chem. Educ.*, 1941, **18**, 330).—The electrode described is suitable for electrometric titrations with the quinhydrone electrode, especially with titrations at small vol. It is more rugged than conventional types. L. S. T.

Applications of the polarograph in soil investigations.—See B., 1942, III, 123.

Symmetrical cells. P. Renaud (*Compt. rend.*, 1941, **213**, 377—379).—Experiments on electrodes (Cu, Fe, Pt, Ta) under repeated dipping in solutions of their respective salts in air and in vac. were made with a micro-ammeter of high sensitivity. Readings indicate the deposition of a unimol. layer on the electrode. There is evidence of two phenomena: a p.d. on dipping and removing the electrode is due to capillary effects or to the formation of a concn. cell by the production at the electrode surface of a thin liquid film having a concn. different from that of the solution; on continued dipping there is chemical action between the solution and the electrode. N. M. B.

Reversible discharge tube. R. K. Asundi, N. L. Singh, and J. D. Singh (*Nature*, 1942, **149**, 22).—A discharge tube which could be made to show either the air spectrum or the H_2 spectrum is described. A. A. E.

Reversible discharge tube. A. G. Gaydon (*Nature*, 1942, **149**, 112).—The behaviour of the discharge tube described by Asundi *et al.* (preceding abstract) is attributed to a leak. A. A. E.

Arc employing high streaming velocity for spectrochemistry. M. F. Hasler (*J. Opt. Soc. Amer.*, 1941, **31**, 140—145).—An arc source is described in which a high streaming velocity through the arc is obtained by packing a space around the lower electrode with a substance (NH_4Cl or sugar C) gas from which carries the sample for analysis mechanically into the arc. For the analysis of powders the sample is mixed with the vaporising material. For the analysis of metals the electrode is formed from the metal sample and the vapour carries with it portions of the metal which are melted by the arc. The arc is more stable than the usual d.c. arc, more sensitive than the spark, and possesses a greater working range than the a.c. arc. The analysis of Zn containing Sn, Cd, and P 0·001—0·01%, Mg and Fe 0·01—0·1%, Cu 0·1—3%, and Al 3·5—4·5%, and of oxide prepared from the same metal is described. O. D. S.

Clean-up of mercury vapour in discharges through hydrogen, helium, and nitrogen. O. S. Duffendack, R. A. Wolfe, and F. Lederer (*J. Opt. Soc. Amer.*, 1941, **31**, 174—176).—When a glow discharge is passed through H_2 saturated with Hg vapour the Hg emission spectrum disappears rapidly. A large amount of Hg may be "cleaned up" in this way. The effect is due to the formation of Hg hydride. This is decomposed at 150°. Hg may be liberated by heating the walls of the discharge tube. The clean-up is inhibited by saturation of the walls with He or by covering them with a layer of sputtered metal. A much smaller clean-up in He and N_2 is $\frac{1}{3}$ that due to adsorption of Hg on the electrodes and tube walls. O. D. S.

Modification of the Barnes Geiger-Müller counter. J. C. Wang, J. F. Marvin, and K. W. Stenstrom (*Rev. Sci. Instr.*, 1942, **13**, 81).—The central element of 0·1-mm. W wire has its lower end fixed in glass, and a glass shield increases the insulating distance between the electrodes. The upper end has a Ni sleeve connecting with a 1-mm. W lead-in. A Pt or Al film is deposited by evaporation on the sensitive portion of the tube. A. A. E.

Precision method of measuring Geiger counter resolving times. Y. Beers (*Rev. Sci. Instr.*, 1942, **13**, 72—76).—By means of formulæ which are derived the resolving time and errors involved can be calc. from the difference between the counting rates due to two separate const. β-ray sources and to the two sources combined. A. A. E.

Electron microscope. H. N. Alyea (*J. Chem. Educ.*, 1941, **18**, 236—237).—An illustrated description. L. S. T.

Capillary pipettes. H. A. Frediani and L. Gamble (*J. Chem. Educ.*, 1941, **18**, 270—271).—A capillary pipette sealed into a protecting, graduated outer tube and operated by means of a rubber policeman is described. L. S. T.

Two simple micro-burettes and an accurate wash-out pipette. I. H. Hadfield (*J.S.C.I.*, 1942, **61**, 45—50).—A description is given of a simple burette made from a glass tube with a jet at one end and a piece of rubber tubing at the other. A rod passing through the rubber tubing expels a vol. of liquid equal to the vol. of the rod which passes into the tube. The distance of travel is read on a scale behind the burette. The capacity is ~3 ml. and vols. can be read to 0·001 ml. In a more accurate model of capacity 0·5 ml. the rubber is dispensed with and the rod is ground to fit the tube with only a small clearance. The head of liquid is reduced by bending the burette tube at right angles to the jet. The rod is impelled by a micrometer and the vols. may be read to 0·0001 ml. A simple wash-out pipette is described in which a plunger is used both to fill and to empty the pipette, and also acts as a reservoir for the H_2O for washing the pipette.

Paper for platinum in flame tests. C. C. Kiplinger (*J. Chem. Educ.*, 1941, **18**, 297).—Paper soaked repeatedly in $NaNH_4HPO_4$ is used in place of Pt wire. Fused $Na_2B_4O_7$ cannot be used in this method. L. S. T.

Making fused porcelain–Pyrex filters. F. E. Holmes (*J. Chem. Educ.*, 1941, **18**, 311—312).—The construction of various types of filter from unglazed porous porcelain discs fused into Pyrex glass is described and illustrated. L. S. T.

Apparatus for autofiltration. G. F. Lewis (*Pharm. J.*, 1942, **148**, 151).—Sterile injections are prepared by filtration through a candle, capillary tubing, and a hypodermic needle directly into a previously sterilised, evacuated, rubber-capped bottle. The apparatus used, which is fully described and figured, entirely precludes contamination. A. A. E.

Pressure filter. A. Wexler (*J. Chem. Educ.*, 1941, **18**, 167—168).—The filter consists of a test-tube drawn out at one end, and fitted with glass chips and a layer of asbestos or filter-paper pulp to act as the filter. The filter is useful for micro-work, for vac. drying, or for heating a ppt. in a current of gas. A high-pressure modification is also described. L. S. T.

Breaking of Pyrex flasks. H. A. Wooster (*J. Chem. Educ.*, 1941, **18**, 196).—300-ml. Pyrex Florence flasks, filled with H_2O, cracked when they were placed on a wire gauze and heated over a blast lamp. When heated in the inner cone of the same flame without the interposition of the gauze, the H_2O boiled without fracture of the flask. Cracking is also avoided by suspending the flasks ~2 cm. above the gauze. It is attributed to local overheating by the hot wire. Wire gauze reaches the temp. given when heated in the flame of a blast lamp, 1300°, Fisher burner, 1080°, Meker burner, 1080°, and Bunser burner 970°. L. S. T.

Laboratory steam trap. S. H. Tucker (*Chem. and Ind.*, 1942, 194).—The trap contains a glass float so shaped that it can effectively seal the rubbered end of the H_2O-exit tube even when the apparatus or float is not vertical. A. A. E.

Hydrometer-type float method for measuring surface and interfacial tensions. B. Vonnegut (*Rev. Sci. Instr.*, 1942, **13**, 82—83).—A float for measurement of γ has a very thin stem and has as small a mass or displacement as is consistent with maintenance of the perpendicular position. Such floats are described and the necessary measurements and formula for calculating γ are given. A. A. E.

Large crystals. R. P. Seward (*J. Chem. Educ.*, 1941, **18**, 346).—Large crystals that require no protective coating can be grown in solutions containing approx. equal wts. of Cr alum and K alum. L. S. T.

Apparatus for producing liquids of low b.p. E. B. Wilson (*J. Chem. Educ.*, 1941, **18**, 394—395). L. S. T.

Photo-electric turbidimeter for use in solution kinetics. F. C. Tompkins (*Trans. Faraday Soc.*, 1942, **38**, 128—131).—Construction and use are described. The instrument is designed to follow the course of pptn. reactions and can be arranged to give direct readings or used as a null-point instrument. F. L. U.

Improved dilatometer. A. Furst (*J. Chem. Educ.*, 1941, **18**, 335).—A dilatometer for studying rates of reaction is described. L. S. T.

Non-recording densitometer. W. S. Baird (*J. Opt. Soc. Amer.*, 1941, **31**, 179—180).—Apparatus is described. O. D. S.

Ether-insoluble stopcock lubricant. B. L. Herrington and M. P. Starr (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 62).—Starch–glycerol gel, prepared by heating a suspension of 9 g. of sol. starch in 22 g. of glycerol to 140°, decanting, and keeping overnight, furnishes a lubricant insol. in Et_2O and light petroleum. It is sol. slowly in H_2O. L. S. T.

Anchor-type laboratory stirrer for viscous or foamy materials. R. E. Forrest (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 56).—An anchor-shaped stirrer cut from sheet metal is fitted into the flask, suppresses foaming, and prevents pptd. solid material from adhering to the sides of the flask. L. S. T.

Electrical precipitator for research and demonstration purposes. J. H. Billman and R. V. Cash (*J. Chem. Educ.*, 1941, **18**, 261—262).—The modified Cottrell precipitator described and illustrated coagulates effectively AcOH mist and tobacco smoke. L. S. T.

Dry polishing of mineragraphic specimens. H. J. Fraser and R. von Huene (*Econ. Geol.*, 1939, **34**, 467).—Details of the method, which is particularly suitable for hard minerals, are given. L. S. T.

Molecular refraction nomograph.—See A., 1942, I, 165.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Lecture demonstrations in chemistry. S. B. Arenson (*J. Chem. Educ.*, 1941, **18**, 168—169; cf. A., 1941, **I**, 133).—Demonstrations for the following are described: decomp. of $KClO_3$ catalysed by MnO_2, Gay Lussac's law of vols., the re-dissolution of carbonates in excess of CO_2, the motion of mols. in gases, explosion range of gases, reaction velocity, cold P flame, and the prep. of blueprints. L. S. T.

Lecture experiments using rubber balloons. E. T. Mitchell (*J. Chem. Educ.*, 1941, **18**, 269).—The law of mass action is demonstrated by the different rates at which equal-sized balloons are filled by H_2 from the action of M- to 6M-HCl on Zn. Common ion effect is shown similarly by the action of AcOH and AcOH + NaOAc on $CaCO_3$, and catalysis by the action of Zn and Zn + Cu on dil. H_2SO_4. L. S. T.

Ammonium chloride "chimney." H. L. Davis and J. W. Neckers (*J. Chem. Educ.*, 1941, **18**, 292).—The deposition of a solid ring, ~18 mm. high, of NH_4Cl at the mouth of a test-tube is described and illustrated. L. S. T.

Demonstration of electrolytic extraction of aluminium. J. F. Castka (*J. Chem. Educ.*, 1941, **18**, 193—194).—Details for a lecture demonstration are given. L. S. T.

Simple method of building close-packed molecular and crystal models. E. A. Hauser (*J. Chem. Educ.*, 1941, **18**, 164—166).—Balls of wood, glass, metal, plastics, rubber, or, preferably, pressed cork are coated with unvulcanised rubber, which sticks only to itself. Details of the method and illustrations (AgBr, Si, Na silicate, and montmorillonite) are given. L. S. T.

Equipment for studying electrolysis and conductivity. G. B. Heisig and H. P. Klug (*J. Chem. Educ.*, 1941, **18**, 314). L. S. T.

Demonstration involving air pressure. G. M. Lisk (*J. Chem. Educ.*, 1941, **18**, 346).—Apparatus for demonstrating the absorption of NH_3 or HCl by H_2O is described. L. S. T.

Demonstrations of gas explosions. W. E. Thrun and J. M. Lien (*J. Chem. Educ.*, 1941, **18**, 375—377).—Demonstrations showing differences in violence of explosive mixtures in bubbles, balloons, and glass containers are described. L. S. T.

Chart for qualitative analysis. L. P. Biefeld (*J. Chem. Educ.*, 1941, **18**, 374).—A diagram showing the increasing solubility of the sulphides of the commoner cations is given. L. S. T.

Lecture and laboratory notebooks of three early Irish-American refugee chemists, W. J. Macneven, J. P. Emmet, and T. Antisell. C. A. Browne (*J. Chem. Educ.*, 1941, **18**, 153—158).—Historical. L. S. T.

XIII.—GEOCHEMISTRY.

Geochemical study of Saratoga mineral waters by a spectrochemical analysis of their trace elements. L. W. Strock and S. Drexler (*J. Opt. Soc. Amer.*, 1941, **31**, 167—173; cf. A., 1942, I, 120).—The analytical methods used in the previously reported investigation are described in detail. Erratic results obtained in the spectrochemical determination of Zr co-pptd. with $Fe(OH)_3$ were due to the formation of ZrO_2, probably by decomp. of Fe^{II} zirconate, during a short, but not accurately controlled, preheating period ~10 sec. during striking of the arc. O. D. S.

Theory of ground-water motion. (A) H. Krutter. (B) M. K. Hubbert (*J. Geol.*, 1941, **49**, 324—326, 327—330).—A criticism (cf. A., 1941, **I**, 433) and a reply. L. S. T.

Hydrothermal deposits in the Specimen Mountain volcanics, Rocky Mountain National Park, Colorado. E. E. Wahlstrom (*Amer. Min.*, 1941, **26**, 551—561).—Hydrothermal solutions, rising from depth, have deposited jasper (I) and opal which have replaced pitchstone flows adjacent to thrust faults. Locally, the (I) forms geodes, partly or completely filled with agate, onyx, opal, calcite, and minor amounts of allophane and chloropal. L. S. T.

Geological occurrence and practical relations of water, gas, and oil encountered in driving the Claremont tunnel through the Beverley Hills. G. D. Louderback (*Econ. Geol.*, 1939, **34**, 469—470).—No H_2O-bearing strata were found in the Jurassic, Cretaceous, or Miocene formations. The main H_2O flows came from Pleistocene stream beds and the Pliocene volcanics. Hydrocarbon gas was found in the Cretaceous, and light oil seepages in the freshwater Pliocene. L. S. T.

Formation of sedimentary deposits of calcium phosphate. A. Rivière (*Compt. rend.*, 1941, **213**, 74—77).—The concn. of phosphates in sea-H_2O is always < the solubility of these compounds under the conditions of p_H pertaining. Where there is a considerable deposit of phosphates it has been due to the presence of org. matter. A. J. M.

Mineral deposition at Steamboat Springs, Nevada. V. P. Gianella (*Econ. Geol.*, 1939, **34**, 471—472).—Minerals are now being deposited from the hot (up to 95°) waters, which have high [NaCl] and [SiO_2], but are low in Ca. The large deposit of sinter is mainly SiO_2, but a small carbonate content occurs in some areas. Sulphide minerals occur in the sinter, and some cinnabar has been mined. A deposit that quickly chokes the casings of borings is practically pure $CaCO_3$, and not SiO_2. Metastibnite in quantity, stibnite, and pyrite have been ejected. L. S. T.

Sub-river solution cavities in the Tennessee Valley. B. C. Moneymaker (*J. Geol.*, 1941, **49**, 74—86).—Deep drill holes and deep open-cut excavations at numerous widely-separated localities in an extensive area of variable geological character disclose the presence of solution cavities at depths considerably below the beds of the master streams. The development of solution channels in limestone, dolomite, marble, and other carbonate rocks within the zone of saturation appears to be a normal geological process. L. S. T.

Meteorites and the age of the solar system. W. J. Arrol, R. B. Jacobi, and F. A. Paneth (*Nature*, 1942, **149**, 235—238).—The accuracy of radioactivity measurements has been improved by modifications in procedure which are summarised. Age vals. are determined by the He, Th, and U + actino-U contents. Six Fe meteorites of widely differing He content were re-examined; the calc. ages vary from 60 to 7600 × 10^6 years. The applicability of the He method is discussed. Among 44 other Fe meteorites which have been studied, none contains more He than that affording the highest val. above, and moreover a He content of twice the highest val. would raise the age val. to only 8500 × 10^6 years. Ages of the other 44 meteorites are calc. on the assumption that the average activity found for the six Fe meteorites is valid for the others also. It is concluded that the age of the solar system cannot be $< 7 \times 10^9$ years. A. A. E.

Origin of underground carbon dioxide. F. E. E. Germann and H. W. Ayres (*J. Physical Chem.*, 1942, **46**, 61—68).—The increase in pressure which occurs when finely powdered natural $CaCO_3$ is heated at 98° in presence of H_2O vapour is > in absence of H_2O vapour. The max. pressure depends on the amount of sample, indicating that the reaction is not the simple hydrolytic decomp. of $CaCO_3$, a more reasonable explanation being that impurities in the sample, *e.g.*, SiO_2, Al_2O_3, react with $CaCO_3$. The data do not support the view that the high underground pressure of CO_2 cannot be due to the thermal decomp. of $CaCO_3$, merely because it is assumed that the temp. prevailing in the neighbourhood of igneous intrusions are too low to produce such pressure. Such assumptions are based on calculations using the dissociation pressure of pure $CaCO_3$, whereas natural $CaCO_3$ contains impurities. C. R. H.

Distribution of helium and radioactivity in rocks. III. Radioactivity and petrology of some Californian intrusives. E. S. Larsen and N. B. Keevil (*Amer. J. Sci.*, 1942, **240**, 204—215; cf. A., 1942, I, 122).—Data for minerals separated from the Lakeview tonalite and two other granitic rocks from the batholith of S. California are recorded and discussed. The distribution of radioactivity is non-uniform, the bulk of the radioactive elements having separated with the early minor constituents zircon (I), apatite, and sphene (II). The He retentivities of the constituent minerals in decreasing order are hornblende, biotite, quartz, apatite, felspar, (II), and (I). Field data and corr. He ages indicate a Jurassic rather than a Cretaceous age for the earliest intrusives in the batholithic complex of S. California. L. S. T.

Identification of minerals by means of *X*-rays. M. A. Peacock (*Trans. Roy. Soc. Canada*, 1941, [iii], **35**, IV, 105—112).—Principles of the method are outlined, and its possibilities, particularly the identification of minerals described originally as distinct species, are discussed and illustrated. L. S. T.

Ep-Archean and Ep-Algonkian erosion surfaces, Grand Canyon, Arizona. R. P. Sharp (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1235—1270).—Chemical weathering, the ultimate product of which consists of quartz, muscovite, clay, and hydrated Fe oxides, is described and discussed. L. S. T.

Granite drift near Brittas, on the border between Co. Dublin and Co. Wicklow. A. Farrington (*Proc. Roy. Irish Acad.*, 1942, **47**, **B**, 279—291).—Sands and gravels of granitic origin are described, and mineral analyses recorded and discussed. L. S. T.

Microchemical investigations on spotted muscovite mica. J. Das-Gupta (*J. Indian Chem. Soc.*, 1941, **18**, 381—382).—The black material present as minute specks in some specimens of muscovite mica has been analysed by micro-methods, and found to be magnetite. F. J. G.

Differentiation of the Palisade diabase, New Jersey. F. Walker (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1059—1106).—The 15 new chemical analyses [F. A. Gonyer] recorded and the micrometric measurements of 150 rock sections show that crystal fractionation accounts satisfactorily for most of the differentiation phenomena displayed by the sill. The main differentiation was effected by the settling of early-formed olivine crystals followed later by pyroxene. L. S. T.

Rock series in diabase sills at Duluth, Minnesota. G. M. Schwartz and A. E. Sandberg (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1135—1172).—Petrography is described and chemical analyses and variation diagrams are given for the rocks of the Endion, Northland, and Lester River sills. Possible origins of the rocks in the sills are discussed. L. S. T.

Origin of the muck-silt deposits at Fairbanks, Alaska. R. Tuck (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1295—1310).—The silt of the overburden that blankets these Au-bearing gravel deposits is æolian in origin, whilst the inorg. material of the muck consists mainly of wind-blown particles. L. S. T.

Concentric patterns in the granites of the Llano-Burnet region, Texas. D. Keppel (*Bull. Geol. Soc. Amer.*, 1940, **51**, 971—999).—The larger bodies of pre-Cambrian granites of this region show a concentric arrangement of three textural varieties; these, in order of solidification, are an outer coarse-grained granite, an intermediate zono of porphyritic coarse-grained granite, and a core of medium-grained granite. Petrographic and chemical (recorded) analyses show that the three textural varieties are similar. L. S. T.

Audubon-Albion stock, Boulder Co., Colorado. E. E. Wahlstrom (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1789—1820).—This stock is a composite intrusive consisting mainly of monzonite, and injected into and cross-cutting pre-Cambrian granite, gneiss, and schist. Syenogabbro, the oldest rock in the stock, is probably a chilled phase of the parent magma from which the other types of rock were derived. Chemical analyses of this rock show relatively high K_2O, and are similar to those of basalt flows interbedded with the sediments of the Denver formation near Golden, Colorado. L. S. T.

Archean metaconcretions of Thunder Lake, Ontario. F. J. Pettijohn (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1841—1850).—Silicated calcareous concretions occur in paragneisses and mica schists of Archean age near Thunder Lake in N.W. Ontario. Anorthitic plagioclase, quartz, and hornblende are the chief constituents. Chemical analyses [R. B. Ellestad] are recorded. L. S. T.

Igneous rocks of the Terlingua-Solitario region, Texas. J. T. Lonsdale (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1539—1626).—Geology and petrography are described. The igneous rocks include an analcite-bearing series and intermediate, trachytic, and rhyolitic types, most of which are soda-rich. Chemical analyses [R. B. Ellestad] and variation diagrams are given. L. S. T.

Measuring grain boundaries in crystalline rocks. G. W. Bain (*J. Geol.*, 1941, **49**, 199—206).—Technique for measuring grain perimeters and surfaces in cryst. rocks is outlined. Vals. for the range of cryst. limestones illustrate the method. Application of the results to the determination of width of intergranular space and adsorptive capacity is indicated. L. S. T.

Structural control of ore deposition: effects of mineral sequence. C. D. Hulin (*Econ. Geol.*, 1939, **34**, 471).—The depositional sequence of minerals of hydrothermal ores is also a sequence of introduction of elements. Common metals are introduced in the order Fe, Zn, Pb, Cu, Ag, and Au. The relative time of appearance of these elements is essentially fixed for all ores, but the time of persistence and concn. of each metal in the solutions vary markedly. This obtains also with the elements (sequence, O, S, As, and Sb) combining with these metals. Minerals of Sn, W, Mo, and Bi are erratic in their time relation to the more common metals, but are coincident in time with the main period of quartz deposition. During mineralisation the SiO_2, W, Sn, Mo, and Bi group is independent of the Fe, Zn, etc., and associated acids group. L. S. T.

Types of colouring in minerals. T. G. Kennard and D. H. Howell (*Amer. Min.*, 1941, **26**, 405—421).—Data relating to the various types of colouring that can occur in minerals are collected and correlated. The types are classified according to the means or mechanism of the colour production. A fundamental distinction is made between colouring due to characteristic absorption or reflexion that is determined by the chemical composition of the substance, and colouring caused by structural characteristics. Both body colour and surface colour are significant in the first type, whilst interference and scattering are the important factors in the second. The effect of particle size on colour is also discussed. Practical criteria for recognising and identifying the types of colouring shown in any particular specimen are suggested. L. S. T.

Retrograde metamorphism. G. M. Schwartz and J. H. Todd (*J. Geol.*, 1941, **49**, 177—189).—Retrograde metamorphism is defined as any change, not caused by weathering, by which a metamorphic mineral or rock alters to a mineral or rock of lower grade, *i.e.*, to minerals and rocks more stable at lower temp. and pressures, and containing more H_2O. Retrogression is due mainly to the attack of hydrothermal solutions on so-called high-grade metamorphic minerals. Large amounts of H_2O, as in the change pyroxene → amphibole → biotite → chlorite, are required. The theory of retrograde metamorphism outlined by Becke and elaborated by Harker is probably not adequate to explain the changes cited repeatedly as retrograde. L. S. T.

Optical properties of cordierite in relation to alkalis in the cordierite–beryl structure. R. E. Folinsbee (*Amer. Min.*, 1941, **26**, 485—500).—A chemical analysis of optically positive, gem-quality cordierite (I) from a new occurrence, north of Great Slave Lake, is recorded; it shows that pure (I) is low in H_2O+ (0·67%). The analogy between the structure of (I) and beryl (II), indicated by *X*-ray data (A., 1929, 1223), is confirmed by similarities in the chemical, crystallographic, optical, and physical properties of the two minerals. The nature of the isomorphous substitution accompanying the introduction of alkalis into the (II) structure is established for an alkali-rich (II), and confirmed by examination of the relation of the structural formulæ of alkali (II) and (I). The anomaly of the existence of optically-positive (I) is explained by variations in the alkali content of (I), an increase in which increases n, decreases the birefringence, and lowers the optic angle (cf. A., 1938, I, 163). Optically positive cordierites are, in general, low in alkalis and high in CaO. The importance of complete chemical analyses for the elucidation of the problems of mineralogy is emphasised. L. S. T.

Manganese deposits of Costa Rica, Central America. B. N. Webber (*Amer. Inst. Min. Met. Eng.*, 1942, **6**, *Tech. Publ.* 1445, 7 pp.).—History, production, and general geology are described. The Mn deposits are of two types, (i) hydrothermal deposits of hypogene origin, associated with abundant jasperoidal SiO_2, and (ii) concns. and superficial replacement deposits of supergene origin. The chief Mn oxides identified are pyrolusite, manganite, and psilomelane. The deposits are described. L. S. T.

Manganese deposits in the Olympic Peninsula, Washington. C. F. Park, jun. (*Econ. Geol.*, 1939, **34**, 944—945).—Chocolate-red limestone (I), containing as much as 10% of finely-divided hæmatite, forms the host rock for the Mn. The limestones are associated with lavas, particularly pillow basalts. The Mn is of low-temp., hydrothermal origin, and occurs in irregular lenses and bodies that have replaced red (I) or red limy argillite. The Mn bodies are generally small, and contain up to a few hundred tons of ore. At Crescent mine, ~25,000 tons of high-grade hausmannite (II) have been mined. The mineral composition of the ores is unique in that the ore consists of (II), and a fine-grained mixture of Mn silicates called "bementite." Small amounts of cinnabar and native Cu are distributed widely throughout the deposits. The (II) deposits are low in SiO_2. L. S. T.

Tungsten-bearing manganese deposit at Golconda, Nevada. P. F. Kerr (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1359—1389).—W-bearing manganiferous and ochreous deposits underlie calcareous tufa. The W ore blankets an erosion surface, and beneath the blanket deposits are veins of similar mineralisation, which probably provided the source of the overlying ores. The ore minerals are colloidal in origin, WO_3,nH_2O having been adsorbed in psilomelane (I) and limonite (II) while both were gels. The ore-bearing layers and the tufa are considered to be chiefly of hot spring origin. The ores consist of (II) containing adsorbed WO_3,nH_2O, W-bearing (I), for which the name *tungomelane* is suggested, and W-bearing hollandite (III). (III) has formed along gel cracks in (I) as a later part of the Mn mineralisation. An older jarosite vein containing small amounts of W appears to represent a level of mineralisation even lower than the veins immediately below the blanket deposits. Mineralisation started probably with chertification and silification, but resulted ultimately in pptn. of W, Fe, Mn, and tufa. The W-bearing (II) (chemical analysis given) contains 2·64% of WO_3, and the deposits contain enough W for economic development. L. S. T.

Studies of the Lake Superior Pre-Cambrian by accessory-mineral methods. S. A. Tyler, R. W. Marsden, F. F. Grout, and G. A. Thiel (*Bull. Geol. Soc. Amer.*, 1940, **51**, 1429—1538).—Heavy mineral analyses of numerous rocks from the States bordering Lake Superior are recorded and discussed. The average relative % of accessory minerals is different for rocks of different composition even if the rocks are of the same age, and appear to be related genetically. The type of dominant zircon in Keeweenawan rocks is remarkably const. regardless of rock composition, and almost regardless of texture and cooling history of the rock. The striking changes in heavy accessory minerals in weathering and sedimentation are described for four districts. The data do not agree wholly with previous views as to which minerals are most rapidly or the least attacked by such processes. L. S. T.

Geology of Buxa Duars. A. Lahiri (*Quart. J. Geol. Soc. India*, 1941, **13**, 1—62).—The geology, petrology, and petrography, stratigraphy and structure of the rocks are described. The most important deposit economically is dolomite (I), which is abundant and of good quality, with nests of calcite. Chalcopyrite with Fe pyrite and pyrrhotite, and some azurite, has been found. Argentiferous galena with cerussite, sphalerite, and limonite occurs with the (I). Fe ores, coal, and good quality lignite also occur. Talc schists from the Jainti Hills are used for refractories and mosquito spray. Quartzite is used as building material. L. S. T.

Atomic arrangement of sylvanite. G. Tunell (*Amer. Min.*, 1941, **26**, 457—477).—Weissenberg and powder diffraction data are

recorded for sylvanite (I) from Cripple Creek, Colorado, from Săcărâmbu, Transilvania, and from the Buena Mine, Colorado. a_0 is 8·94, b_0 4·48, c_0 14·59 A. (all ±0·02 A.), and β 145° 26′±20′, $\rho_{calc.}$ 8·17, $\rho_{obs.}$ 8·16; space-group C_{2h}^4—$P2/c$. The unit cell contains $2AuAgTe_4$ with a small part of the Ag replaced by Au. At. positions are given; they have been confirmed by Fourier projection. Each Au and each Ag is surrounded octahedrally by 6Te, and each Te is surrounded octahedrally by 3Te, 2Au, and 1Ag, or by 3Te, 2Ag, and 1Au. A model showing the arrangement of atoms in (I) is reproduced. Interat. distances are Au—Te, 2·67, 2·76, and 3·26 A., Ag—Te 2·69, 2·94, and 3·19 A., and Te—Te, 2·88, 3·56, 3·64, and 3·64 A. L. S. T.

Vermiculite and hydrobiotite. R. F. Ruthruff (*Amer. Min.*, 1941, **26**, 478—484).—Chemical analysis supports the findings of Gruner (A., 1935, 841) that hydrobiotite (I) consists of interstratified layers of vermiculite (II) and biotite, probably in the ratio 1 : 1 or 3 : 2. Heating with dil. H_2SO_4 removes oxides from (II), leaving SiO_2 in the form of white plates. Complete removal of all oxides other than SiO_2 from (I) is more difficult. (I) saturated with conc. H_2SO_4 and exposed to air for ≤24 hr., or steamed for a shorter time, exfoliates considerably. (II) soaked in conc. H_2SO_4 and exposed to air effloresces with the elimination of salts, but shows no further change. L. S. T.

Intrusive rocks of the Okanogan valley, and the problem of their correlation. K. B. Krauskopf (*J. Geol.*, 1941, **49**, 1—53).—Eight plutonic masses, which include granodiorites, quartz-diorite, metagabbro, and malignite, are described. Chemical analyses are recorded. L. S. T.

Grossularoid group (hibschite, plazolite). D. S. Beliankin and V. P. Petrov (*Amer. Min.*, 1941, **26**, 450—453; A., 1940, I, 45).—Chemical analyses of hibschite (I) from Nikortzminda, Georgia, and plazolite (II) from Crestmore, California, are recorded. (I) is grossularite with one mol. of SiO_2 replaced by $2H_2O$. A comparison of the occurrence, paragenesis, and properties of Bohemian and Caucasian (I) with those of (II) shows that (I) and (II) are both members of the same mineral group for which the name grossularoid group is suggested. Chemically, (II) differs from (I) by a small and variable content of CO_2. (I) and (II) are less rare than is supposed. The heating curve of (I) shows an endothermal effect at 650—690°, and two exothermal effects at 870° and 940°. L. S. T.

***X*-Ray crystallography of seamanite.** D. McConnell and W. L. Pondrom, jun. (*Amer. Min.*, 1941, **26**, 446—447).—Seamanite from Chicagon mine, Michigan, has a_0 7·83, b_0 15·14, c_0 6·71 A. (all ±0·02 A.), $\rho_{calc.}$ 3·09, $\rho_{obs.}$ 3·08; the space-group is probably $Pbnm$—V_h^{16}. L. S. T.

Relation of Phillipine mining districts to the structural history of the archipelago. E. Wisser (*Econ. Geol.*, 1939, **34**, 468—469).—The rock formations, the structure, and the geologic history of the Phillipine Archipelago are discussed with special reference to the Miocene Revolution, which culminated in the Au-quartz veins, the present source of Phillipine Au production. L. S. T.

Columbomicrolite from Eshowe, Natal. J. E. de Villiers (*Amer. Min.*, 1941, **26**, 501—506).—Columbomicrolite, a new member of the pyrochlore group occurring as small grains in albitite, has Nb_2O_5 71·2%, Ta_2O_5 none, TiO_2 1·8, Fe_2O_3 trace, Ce_2O_3 none, CaO 15·2, Na_2O 10·0, H_2O 1·8, total 100·0% (recalc. to 100·0%), ρ 4·16, n 2·152. The essential chemical characters of each member of the pyrochlore group are summarised. L. S. T.

Origin of the magnetic iron ores in the Lyon Mountain region, N.Y. W. J. Miller (*Econ. Geol.*, 1939, **34**, 947).—A discussion. L. S. T.

Galena–sphalerite deposit in northeast Alabama. T. G. Andrews (*Econ. Geol.*, 1939, **34**, 945).—Galena and sphalerite occur in Ordovician limestone near Angel Station, Calhoun Co., Alabama. L. S. T.

Spinel group. A. N. Winchell (*Amer. Min.*, 1941, **26**, 422—428).—Members of this group are represented on a diagram, which also shows the variations in ρ that result from variations in composition. L. S. T.

Crystallographic notes. Cahnite, stolzite, zincite, ultrabasite. C. Palache (*Amer. Min.*, 1941, **26**, 429—436).—Crystals of cahnite from Franklin, N.J., belong to the tetragonal disphenoidal class, $\bar{4}$. Crystallographic data for stolzite (I) from Primos Mine and Reef Mine, Arizona, and for (I) from Nigeria are recorded. (I) from Nigeria has ρ 8·34±0·004. Data for zincite from Franklin, N.Y., are also given. Ultrabasite is identical with diaphorite. L. S. T.

Volcanic rocks of the Western San Augustin plains district, New Mexico. W. E. Powers (*J. Geol.*, 1941, **49**, 207—217).—Mountains surrounding these plains are composed of an unusual variety of volcanic rock types, including rhyolite, andesite, basalt, silicic and basic tuff, and agglomerate. L. S. T.

Idocrase and scapolite from Manchester, New Hampshire. G. W. Stewart (*Amer. Min.*, 1941, **26**, 509—511).—Idocrase (I) occurs in calcareous seams in the bedrock of biotite schist; occasionally, a crystal of (I) occurs embedded in calcite. Scapolite (chemical analysis given) is found usually replacing quartz. L. S. T.

Skeletonised apophyllite from Crestmore and Riverside, California. E. H. Bailey (*Amer. Min.*, 1941, **26**, 565—567).—Occurrences of skeletonised apophyllite (SiO_2 88·54, H_2O 7·21, MgO ~4%, with small amounts of Fe, Mn, and traces of Al, Cu, Ag, Ti, and Ni) are described. Retention of some of the optical and physical properties of the parent mineral indicates that the original apophyllite has undergone a selective leaching process in which Ca, F, and K have been removed without destroying the SiO_2 framework of the crystals. L. S. T.

Occurrence of martite in micaceous hæmatite near Esmont, Virginia. A. A. Pegau and W. C. Overstreet (*Amer. Min.*, 1941, **26**, 512).—The martite occurs as octahedra disseminated through a dark steel-gray hæmatite. L. S. T.

Formation of jarosite on pyrite ornaments. F. H. Pough (*Amer. Min.*, 1941, **26**, 562—564).—The formation of jarosite from beads of pyrite buried in earth 600 years ago is described. Turquoise pendants buried at the same time are unaltered. L. S. T.

Igneous rocks of the Stanner–Hanter district, Radnorshire. N. Holgate and K. A. K. Hallowes (*Geol. Mag.*, 1941, **78**, 241—267).—The igneous rocks of the district are divided into (i) fine dolerites, (ii) gabbros, (iii) acid types, and (iv) later dolerites. Their distribution and petrology are described and discussed. L. S. T.

Chilean hexahedrites, and the composition of all hexahedrites. E. P. Henderson (*Amer. Min.*, 1941, **26**, 546—550).—New chemical analyses recorded for Chilean hexahedrites show no significant variations in composition, and since the meteorites have been found over a restricted area, it is probable that they are related to a single fall. In composition these hexahedrites are similar to those from other localities; the Ni content lies between 5·5 and 5·6%. The composition agrees with the equilibrium data for the system Fe–Ni. Hexahedrites are similar in structure to kamacite, the chief alloy in octahedrites. L. S. T.

Stibnite deposits of Crucsom in Upper Hungary.—See B., 1942, I, 240.

Composition and properties of some New Zealand glauconites. C. O. Hutton and F. T. Seelye (*Amer. Min.*, 1941, **26**, 595—604).—Chemical analyses and optical data for seven pure glauconites from sediments of Upper Cretaceous and Tertiary age are recorded and discussed. Data showing the amounts of oxides removed by treatment with HCl of different concns. are also recorded. Curves showing the relation between refractive indices and Fe_2O_3 content are given. Gruner's formula for glauconite (A., 1936, 49) is supported. L. S. T.

Diabolite from Mammoth mine, Tiger, Arizona. C. Palache (*Amer. Min.*, 1941, **26**, 605—612).—Crystallographic data for diabolite (I), ditetragon-pyramidal, hardness 2½, ρ 5·42±0·01, are recorded. (I) is uniaxial negative, with ω 1·98±0·01 and ϵ 1·85±0·01 [H. Berman], a_0 5·83±0·02, c_0 5·46±0·02, V_0 185·58 A.³ [C. W. Wolfe]; space-group $P4mm$. (I) has PbO 72·01, CuO 12·68, Cl 11·42, H_2O 6·03, insol. 0·19, total 102·33, less O for Cl 2·57, 99·76% [F. A. Gonyer], and the unit cell is $Pb_2CuCl_2(OH)_4$. (I) is distributed widely in the Collins Vein of the Mammoth mine, and occurs with linarite. L. S. T.

Qualitative colour test for montmorillonite type of clay minerals.—See B., 1942, III, 65.

Coal palæobotany. R. Thiessen and G. C. Sprunk (*U.S. Bur. Mines*, 1941, *Tech. Paper* 631, 56 pp.).—The identity of the plants and of the plant remains from which the majority of coals have been derived are discussed. In the Palæozoic coals plants of three types are easily recognised: coniferous-like, cycadophyte, and lycopod. No other types have been identified with certainty. These plants are not mixed promiscuously throughout the coal, but one type predominates in a given coal bed or a particular layer thereof. The coniferous-like plants, the cordaitales, are represented in coal by the xylem, bark, and leaves and by resinous inclusions thereof. The most easily recognised lycopod tissues are from the periderm or outer bark, which was a very thick-walled, highly lignified tissue which resisted the peat- and coal-forming processes more than other tissues and hence remained in larger proportions. Cycadophytes were abundant contributors to the Palæozoic coals, some of which are composed predominantly of cycadophytes, *e.g.*, the Pittsburgh bed. These plants are represented in coals by the xylem, periderm, leaves, petioles, pollens, and resinous contents and, particularly, by the mucilaginous contents of the so-called gum ducts. Numerous coal sections showing the nature and type of the various plant remains are illustrated. H. C. M.

Bristol and Somerset coalfields.—See B., 1942, I, 215.

Correlation of marginal beds of Upper Silesian coal formation.—See B., 1942, I, 215.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JULY, 1942.

I.—SUB-ATOMICS.

Absorption spectra of gases in the extreme ultra-violet. T. Takamine and Y. Tanaka (*Astrophys. J.*, 1941, **93**, 386—390).—Absorption spectra of H, He, Ne, and A are photographed with a 20-cm. grating at grazing incidence in vac. Results are discussed. E. R. R.

Blank and background effect on photographed spectral lines.—See A., 1942, I, 249.

Improved source for the Lyman continuum in the vacuum ultra-violet.—See A., 1942, I, 212.

Rydberg corrections for *D* terms in He I. L. Pincherle (*Physical Rev.*, 1942, [ii], **61**, 156—157).—The interaction between the normal $1snd$- and the $2p2p$-configurations in He I is evaluated. Its contribution to the difference between the Rydberg corrections of the *o*- and *p*-terms is very large, and the theoretical vals. of these differences are too small. N. M. B.

Influence of sample composition on magnesium, cadmium, and lead intensity ratios as radiated from a spark source. G. O. Langstroth and K. B. Newbound (*Canad. J. Res.*, 1942, **20**, **A**, 39—47).—Addition of foreign substances can cause marked variations. L. J. J.

First spectrum of antimony. W. F. Meggers and C. J. Humphreys (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 463—478).—$\lambda\lambda$ and measured intensities are given for 466 neutral Sb lines between 1388·91 and 12466·75 A. Almost 80% of the lines are classified as combinations of 60 even energy levels arising from $5s^25p^2ns$, $5s^25p^2nd$, and $5s5p^4$ configurations and 31 odd levels from $5s^25p^3$, $5s^25p^2np$, and possibly $5s^25p^2nf$. The scarcity of visible lines and the high intense ultra-violet and infra-red radiations are due to the relative vals. of various groups of levels. Several spectral series of the type $5s^25p^3$–$5s^25p^2ns$ are proposed and an abs. val. of 69700 cm.$^{-1}$ is deduced for the ground state, $5s^25p^3.{}^4S_{\frac{3}{2}}$. The principal ionisation potential of Sb is 8·64 v. A. R. P.

Zeeman effects in the arc spectrum of nickel. C. H. Lindsley (*J. Opt. Soc. Amer.*, 1942, **32**, 94—97).—Zeeman data for 171 lines of Ni I in fields of 85700 and 81300 gauss are tabulated. *g* vals. are determined for even energy levels arising from the $3d^84s^2$ and $3d^94s$ configurations and for most of the odd levels arising from the $3d^84s4p$ and $3d^94p$ configurations. O. D. S.

First spark spectrum of neodymium; preliminary classification and Zeeman effect data. W. E. Albertson, G. R. Harrison, and J. R. McNally, jun.[4] (*Physical Rev.*, 1942, [ii], **61**, 167—174).—Classifications from the combination principle are tabulated for 367 lines of Nd II arising from 30 lower and 57 upper levels and are checked by Zeeman-effect measurements at fields up to 87180 oersteds, and by other data. Quantum nos. are assigned to the levels having approx. *LS* coupling, and *g* vals. of all known levels are determined. The lowest term is $4f^4({}^5I)6s-a\,{}^6I$. All low terms found arise from $4f^46s$ and $4f^45d$, and all identified upper terms probably arise from $4f^56p$. The strongest lines belong to the sextet and quartet super-multiplets arising from $4f^4({}^5I)6p$–$6s$. Curves are given showing the variation, in the progression La II, Ce II, Pr II, and Nd II, of the binding of terms arising from the configurations f^ns, f^np, f^nd, and, where known, f^{n+1}. N. M. B.

Theory of complex spectra. I. G. Racah (*Physical Rev.*, 1942, [ii], **61**, 186—197; cf. Slater, A., 1930, 126).—Mathematical. A closed formula is developed which, for two-electron spectra, entirely replaces the previous lengthy calculations by the diagonal-sum method. Applications are made to some configurations with three or more electrons and to the p^n configurations of the nuclei. N. M. B.

Results with the Coudé spectrograph of the Mount Wilson Observatory. W. S. Adams (*Astrophys. J.*, 1941, **93**, 11—23). E. R. R.

Solar hydrogen vortices. R. S. Richardson (*Astrophys. J.*, 1941, **93**, 24—28). E. R. R.

Ultra-violet emission lines in spectra of Me variables. P. W. Merrill (*Astrophys. J.*, 1941, **93**, 40—46). E. R. R.

Continuous spectrum of stellar atmospheres consisting of atoms and negative ions of H. R. Wildt (*Astrophys. J.*, 1941, **93**, 47—51). E. R. R.

Spectroscopic binary 29 Canis Majoris. O. Struve and F. Sherman (*Astrophys. J.*, 1941, **93**, 84—91). E. R. R.

Some line intensities in [the spectrum of] β Lyræ. J. R. Gill (*Astrophys. J.*, 1941, **93**, 118—127). E. R. R.

Spectrum of β Lyræ in the visual region. J. L. Greenstein and T. L. Page (*Astrophys. J.*, 1941, **93**, 128—132). E. R. R.

Luminosities of the non-variable *c*-stars. R. E. Wilson (*Astrophys. J.*, 1941, **93**, 212—229). E. R. R.

Physical processes in gaseous nebulæ. XI. Strengths of forbidden lines as a function of coupling. G. H. Shortley, L. H. Aller, J. G. Baker, and D. H. Menzel. **XII. Electron densities of some bright planetary nebulæ.** D. H. Menzel and L. H. Aller. **XIII. Electron temperatures of typical planetary nebulæ.** D. H. Menzel, L. H. Aller, and M. H. Hebb. **XIV. Spectrophotometry of typical planetary nebulæ.** L. H. Aller. **XV. Statistical equilibrium of neutral He.** L. Goldberg (*Astrophys. J.*, 1941, **93**, 178—193, 195—201, 230—235, 236—243, 244—249). E. R. R.

Recent shell spectrum of γ-Cassiopeiæ. R. B. Baldwin (*Astrophys. J.*, 1941, **93**, 333—336). E. R. R.

Spectrum of the night sky. C. T. Elvey, P. Swings, and W. Linke (*Astrophys. J.*, 1941, **93**, 337—348). E. R. R.

Spectra of two peculiar stars [MWC 17 and CD—27° 11944]. P. Swings and O. Struve (*Astrophys. J.*, 1941, **93**, 349—355). E. R. R.

Evolution of a peculiar stellar spectrum: Z andromedæ. P. Swings and O. Struve (*Astrophys. J.*, 1941, **93**, 356—367). E. R. R.

Planetary atmospheres and water-cell temperatures. A. Adel and C. O. Lampland (*Astrophys. J.*, 1941, **93**, 391—396). E. R. R.

1914 shell spectrum of ζ Tauri. R. B. Baldwin (*Astrophys. J.*, 1941, **93**, 420—424). E. R. R.

New type of emission in the L_α group of heavy elements. (Mlle.) Y. Cauchois (*Compt. rend.*, 1941, **213**, 121—124).—Certain new satellites are observed in the L_α spectra of elements of at. no. 62—92. These are not due to impurities or to multiple reflexions. The difference in ν between the satellite (α_4) and the main line (α_1) decreases approx. linearly with increase of at. no. The α_4 lines are relatively intense for Th, Bi, Hg, Au, and Pt, but are less intense for lighter elements. The existence of lines of lower frequency than the principal line suggests a type of internal Raman effect. A. J. M.

Precise determination of the fine structure constant from *X*-ray spin doublet splitting. R. F. Christy and J. M. Keller (*Physical Rev.*, 1942, [ii], **61**, 147—152; cf. A., 1941, I, 2).—Mathematical. Corrections to the Sommerfeld formula for the L_{II}—L_{III} *X*-ray spin-doublet splitting, taking account of departures from a pure Coulomb field for heavy elements, are calc. by using Dirac wave functions for a Coulomb field and determining the terms in the electron interaction of order e^2, *i.e.*, of relative order $1/Z$, compared with the Sommerfeld splitting. Application to experimental data for elements $Z = 60$—92 gives the fine structure const. as $1/\alpha = hc/e^2 = 136{\cdot}93 \pm 0{\cdot}18$. N. M. B.

Optical properties of thick magnetic lenses and application of the lenses to β-ray spectrometry. R. E. Siday (*Proc. Physical Soc.*, 1942, **54**, 266—277).—Mathematical. The validity of expressions giving the focussing properties is examined, a method of ray tracing for good image formation is developed and applied, focal lengths and positions of the principal planes are deduced, and results are generalised and extended. N. M. B.

Electron microscope.—See A., 1942, I, 213.

Photophoresis and its interpretation by electric and magnetic ions. F. Ehrenhaft (*J. Franklin Inst.*, 1942, **233**, 235—256).—Experimental data regarding longitudinal, electro-, and magneto-photophoresis and the "trembling effect" are summarised, and the inadequacy of existent theories to explain these phenomena is pointed out. It is shown that irradiated particles behave as if charged and magnetised, and hence it is postulated that light causes or induces magnetism as well as heat and electricity. J. W. S.

Electron polarisation. C. G. Shull (*Physical Rev.*, 1942, [ii], **61**, 198).—400-ke.v. electrons scattered through 90° by Au foils (suffi-

ciently thin to ensure single scattering) were counted in parallel and anti-parallel directions to the incident beam. Corr. results showed an asymmetry of 8%, the reality being confirmed by a val. of 1% in the opposite direction when an Al foil was substituted for the second Au foil. The reflexion transmission asymmetry (cf. Chase, A., 1940, I, 387) was 1·56 for the Au foils. There is a transmission polarisation asymmetry ~2% > the 8% asymmetry as distinct from a reflexion polarisation asymmetry which is ≪ either (cf. Bartlett, A., 1939, I, 594). N. M. B.

Threshold field studies of various positive-corona phenomena. K. E. Fitzsimmons (*Physical Rev.*, 1942, [ii], **61**, 175—182). N. M. B.

Investigation of isotopes in 1941. S. Flügge and J. Mattauch (*Physikal. Z.*, 1942, **43**, 1—5).—A review. A. J. M.

Depolarisation of neutron beams by magnetic fields. O. Halpern and T. Holstein (*Proc. Nat. Acad. Sci.*, 1942, **28**, 112—118).—The quantum-mechanical method described enables the average no. of neutrons in individual spin states to be calc. in transmission through ferromagnets, and shows that the depolarisation depends on ratio of magnetic moment to spin. L. J. J.

Elastic and inelastic scattering of fast neutrons. H. H. Barschall and R. Ladenburg (*Physical Rev.*, 1942, [ii], **61**, 129—137; cf. Dunlap, A., 1942, I, 127).—The 45° and 90° scattering of 2·5-Me.v. *d*–*d* neutrons by C, Al, Fe, Cu, Zn, and Pb is studied by analysing energy distribution of recoiling α-particles in an ionisation chamber. Elastic scattering showed a strong anisotropy, but inelastic scattering is roughly the same for 45° and 90°. The ratio of elastic to inelastic scattering in C, Al, and Pb exceeds that in Fe and Cu. N. M. B.

Mean life of neutrons in water and the hydrogen capture cross-section. J. H. Manley, L. J. Haworth, and E. A. Luebke (*Physical Rev.*, 1942, [ii], **61**, 152—155).—Observations of the time variation of slow-neutron density in a large vol. of H_2O during and after irradiation by D–D neutrons show an exponential growth and decay. Analysis of results and of data on the spatial density distribution, which determines the effect of diffusion, gives 205 ± 10 μ-sec. as the mean life of neutrons in H_2O. This leads to a cross-section of $0·33 \times 10^{-24}$ sq. cm. for the capture of slow neutrons by H. N. M. B.

Rupture of homopolar bonds under the influence of particular emissions in selenium compounds. R. Daudel (*Compt. rend.*, 1941, **213**, 479—481).—When radioactive Se is produced by neutron bombardment of Na_2SeO_3 the activity can be conc. by pptn. with a variety of carriers, indicating that it is present as free atoms. F. J. G.

Resonance scattering of neutrons in helium. W. E. Stephens and H. Staub (*Physical Rev.*, 1939, [ii], **55**, 235).—The nos. of forward recoil particles produced in He and C_2H_6 by neutrons from Be bombarded by 0·6- and 0·9-Me.v. deuterons have been determined in a cloud-chamber. For ~1-Me.v. neutrons there is a relatively large probability of backward scattering in He. This supports evidence for a 0·8-Me.v. unstable state in He (Williams *et al.*, A., 1937, I, 389, 593; Staub and Stephens, A., 1940, I, 383). A. J. E. W.

Structure of the electronic bands of OD. III. M. G. Sastry (*Indian J. Physics*, 1941, **15**, 455—474).—At 3105—3295 A., approx. 360 lines of the (1,1), (2,2), and (3,3) bands of OD have been measured, and the six main branches of each band have been identified. Rotational consts. in good agreement with existing vals. have been calc. and those for $v'' = 3$ are given for the first time. W. R. A.

β-Ray spectrum of ^{13}N and mass of the neutrino. E. M. Lyman (*Physical Rev.*, 1939, [ii], **55**, 234).—The positron spectrum of ^{13}N (produced by bombarding graphite with 5·3-Me.v. deuterons) is studied with a highly resolving magnetic spectrometer. Its end-point energy (E) is 1·198 ± 0·006 Me.v.; since nuclear disintegration and mass-spectrographic data give $^{13}N \rightarrow {}^{13}C + e^+ + (e^-) + \nu + 1·21 \pm 0·09$ Me.v., the fastest β-particles have the total available energy, and the observed is the true end-point. The mass of the neutrino is $0 \pm 0·2m$. A Konopinski–Uhlenbeck curve consistent with most of the data predicts too many high-energy positrons and an E val. 25% > the observed val. A. J. E. W.

Production of penetrating cosmic-ray particles by photons. M. Schein and V. C. Wilson (*Physical Rev.*, 1939, [ii], **55**, 233—234).—Experiments at 25,000 ft. show that an average of two penetrating particles (barytrons?) per min. are ejected in the forward direction from a Pb plate (38 × 5·2 × 2·2 cm.) by non-ionising rays (photons ?). At 25,000 ft. the electron (and hence the photon) intensity is 37 times, and the intensity of penetrating rays is 2·9 times, that at sea level. The derived cross-section for barytron production by photons in Pb agrees approx. with Heitler's theory. A. J. E. W.

Transition curves for electron- and photon-produced showers. N. Nereson (*Physical Rev.*, 1942, [ii], **61**, 111—115).—Air-to-Pb transition curves show that the max. for photon-produced showers is displaced to ~3 mm. greater thickness of Pb relative to the max. for electron-produced showers. This agrees with shower theory. The max. for large showers lies at a greater thickness than that for small showers. No second max. (cf. Altmann, A., 1941, I, 69) is indicated. N. M. B.

Frequency of proton and α-tracks in cosmic-ray "stars." M. M. Shapiro (*Physical Rev.*, 1942, [ii], **61**, 115—120; cf. A., 1942, I, 80).—> 90% of the "star" tracks on a photographic plate kept at 4300 m. for 239 days are produced by protons, and most of the remainder are probably due to α-particles of energy <9 Me.v. N. M. B.

Cosmic-ray theory. B. Rossi and K. Greisen (*Rev. Mod. Physics*, 1941, **13**, 240—309).—A quant. theory of cosmic-ray effects is developed by the extrapolation of the ordinary laws of quantum electrodynamics to cosmic-ray energies. Collision processes, the Compton effect, radiation processes, pair production, and scattering are considered and the results applied to a detailed discussion of the production of showers. O. D. S.

Origin of the soft component of cosmic rays. B. Rossi and K. Greisen (*Physical Rev.*, 1942, [ii], **61**, 121—128; cf. A., 1940, I, 187).—Mathematical. The no. of electrons from mesotron decay (cf. Schein, A., 1941, I, 289) is calc. N. M. B.

Second maximum in the Rossi curve. C. B. O. Mohr and G. H. Stafford (*Nature*, 1942, **149**, 385—386).—Evidence for the existence of the second max. has been obtained. A. A. E.

Introduction to wave mechanics. G. Glockler (*J. Chem. Educ.*, 1941, **18**, 418—423).—A treatment of at. structure problems on the basis of the Bohr theory is outlined. It gives a consistent development for such cases as the H atom, the linear harmonic oscillator, and H_2. L. S. T.

Theory of the electric charge and the quantum theory. III. H. T. Flint (*Phil. Mag.*, 1942, [vii], **33**, 369—383; cf. A., 1940, I, 280).—The author's classical field equations (Fisher and Flint, *Proc. Roy. Soc.*, 1929, **A, 126**, 645) are used as the basis for quantisation. A notation is developed for the expression of differentiation of matrices and extension of the concept of various operators. L. J. J.

Tensor forces and the theory of light nuclei. E. Gerjuoy and J. Schwinger (*Physical Rev.*, 1942, [ii], **61**, 138—146; cf. Rarita, A., 1941, I, 236, 289).—Mathematical. A treatment of the influence of the existence of non-central tensor forces in nuclei on the binding energies of ^3H and ^4He. The tensor forces which produce all the binding in the deuteron are relatively ineffective in binding ^3H and ^4He. The assumption of ordinary and tensor forces of the same range does not represent the properties of ^3H and ^4He. N. M. B.

Reynolds' number for extragalactic nebulæ. F. Zwicky (*Astrophys. J.*, 1941, **93**, 411—416).—Analysis of structures and internal motions of nebulæ, in terms of hydrodynamics of models composed of viscous, compressible fluids, is outlined, and the application of statistical and particle mechanics is discussed. E. R. R.

II.—MOLECULAR STRUCTURE.

Electron diffraction method of determining the structure of gas molecules. R. Spurr and L. Pauling (*J. Chem. Educ.*, 1941, **18**, 458—465).—A review. L. S. T.

Secondary *K* absorption spectra of ferric oxide in the solid and colloidal states. S. Sen (*Indian J. Physics*, 1941, **15**, 433—436).—Both states exhibit extended secondary structure but the positions of succeeding max. and min. are not identical for the two states, nor are the position and width of the primary edges. Evidence is not sufficient to decide the structure of the colloidal particles. W. R. A.

Importance of certain carbon dioxide bands in the temperature radiation of Venus. A. Adel (*Astrophys. J.*, 1941, **93**, 397—400).—CO_2 in the earth's atm. absorbs completely the fundamental emissions ν_2 (14·97 μ.) and ν_3 (4·27 μ.) from the large CO_2 component of the atm. of Venus. Thus the upper-stage bands of the types $\nu_3 \rightarrow (\nu_1, 2\nu_2)$ (near 10 μ.) and $(\nu_1, 2\nu_2) \rightarrow \nu_2$ (near 13 μ.) determine the quality of radiation received from the atm. of Venus. E. R. R.

Resonance bands of NH in spectra of class R. R. Wildt (*Astrophys. J.*, 1941, **93**, 502—504).—Intensities of ultra-violet resonance bands of NH, identified in R-type stars, are compared with those of C_2, CN, and CH. Scattering of these intensities suggests large differences in the relative abundances of H, C, and N. E. R. R.

Grating infra-red solar spectrum. I. Rotational structure of HDO band ν_2. II. Rotational structure of NNO band ν_1. A. Adel (*Astrophys. J.*, 1941, **93**, 506—509, 509—510; cf. A., 1941, I, 319).—The absorption band ν_2 of HDO at 7·12 μ., which appears in the grating infra-red solar spectrum, is rarely observed since it lies in a region reduced to zero intensity by HHO vapour in the atm. The rotational structure of the atm. band ν_1 of NNO at 7·78 μ. is obtained with a 2400-line echelette grating. E. R. R.

Continuous spectra of hydrogen and deuterium. H. M. James and A. S. Coolidge (*Physical Rev.*, 1939, [ii], **55**, 234).—H_2 and D_2 continua arising from transitions from the lower v levels of the

$1s\sigma 2s\sigma\ ^3\Sigma_g$ state to the unstable $1s\sigma 2p\sigma\ ^3\Sigma_u$ state have been completely calc. Franck–Condon approximation is avoided by direct calculation of electric moments of the transitions as functions of r; the moments decrease rapidly as r increases. Spectra are computed for transitions from each of the v levels, and abs. mean lives for the levels are determined. Relative probabilities of excitation from the ground-state by electron impact are estimated, and the spectral intensity due to such excitation is determined for a range of electron energies. Results disagree with observations by Smith (A., 1936, 537) but agree with those of Finkelnberg and Weizel (cf. A., 1931, 779). A. J. E. W.

Infra-red absorption of $^{13}C^{16}O$ at 4·66 μ. R. T. Lagemann (*J. Chem. Physics*, 1942, **10**, 193—194).—The absorption curve of CO shows weaker lines belonging to the R branch of the fundamental band of $^{13}C^{16}O$ interspersed among the lines of the fundamental band of $^{12}C^{16}O$ at 4·66 μ. L. J. J.

C–H bond spectrum in relation to molecular structure. N. R. Tawde (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 137—138).—Variations in vals. of the C–H frequency correspond with a classification into linear, tetrahedral, and planar mols. (~3290, 3020, and 2980 cm.$^{-1}$, respectively). F. J. G.

Reversible discharge tube.—See A., 1942, I, 213.

Clean-up of mercury vapour in discharges through hydrogen, helium, and nitrogen.—See A., 1942, I, 213.

Optical transmissibility of quartz glass. A. Schraub (*Physikal. Z.*, 1942, **43**, 64—69).—Fused quartz, in contrast to cryst. quartz, begins to absorb strongly at 260 mμ. The fluorescence radiation lies in the violet. A. J. M.

Absorption spectra of potassium permanganate in different media. M. P. Murthy and J. Singh (*Current Sci.*, 1942, **11**, 52).—The absorption bands of the MnO_4' ion at 5495, 5255, 5060, and 4900 A. disappear suddenly on adding H_2SO_4 (>11·2N.) or KOH (>1·0N.). W. R. A.

Vibrational structure of electronic transitions for some complex ions. M. L. Schultz (*J. Chem. Physics*, 1942, **10**, 194).—Groups of equidistant absorption bands of Co, Ni, and Fe^{++} aquo- and ammino-complex ions are ascribed to electronic transitions in which the vibrational structure characteristic of the complex ion is resolved. The separation of the bands is characteristic of the ion and is approx. the same in aq. solutions and in the solid hydrates at liquid-air temp. Raman spectra of $Cu(NH_3)_6^{++}$, $Zn(NH_3)_6^{++}$, and $Cd(NH_3)_6^{++}$ give displacements of the same order as the vibrational separations of Ni^{++} aquo- and ammino-complexes. Solid $CoCl_2,6H_2O$ gives a series of 5 bands the separation of which leads to a val. 22 kg.-cal. for the heat of dissociation of $Co(OH_2)_6^{++}$. L. J. J.

Light absorption of the cobaltic complexes. II. Cyanide and thiosulphate complexes. A. von Kiss [with G. Auer and G. Major] (*Z. anorg. Chem.*, 1941, **246**, 28—34).—Extinction curves from 200 to 700 mμ. are recorded for the following complex salts in H_2O at room temp.: $[Co(NH_3)_5(S_2O_3)]Cl$, *trans*-$Na[Co(en)_2(S_2O_3)_2]$, $Na_5[Co(SO_3)_2(CN)_4]$, $K[Co(H_2O)_2(CN)_4]$, $K_4[Co(CN)_5(S_2O_3)]$, $Ag_2[Co(H_2O)(CN)_5]$ (in presence of KCN), $K_4[Co(CN)_5(S_2O_3)_3]$ (in presence of $Na_2S_2O_3$), and *iso*-$H_4[Co(CN)_5(S_2O_3)]$. Possible interpretations are discussed. F. J. G.

Light absorption by unsaturated compounds in the near ultra-violet and visible due to electron cloud oscillations. A. Henrici (*Z. physikal. Chem.*, 1940, **B**, **47**, 93—126).—An attempt is made to calculate the characteristic vibrations of the p-electron cloud, associated with the mol. as a whole, in mols. containing conjugated double bonds, and to calculate the red shift with increasing no. of conjugated double bonds. The calc. long-λ limit of absorption of C_6H_6 is 3000 A. Fair agreement with known absorption vals. is obtained for hydrocarbons from anthracene to pentacene, and for dephenylpolyenes. Agreement is improved by taking polarisability and dielectric const. into account. In C_6H_6 the bands at 2000 and 2500 A. correspond with electron vibrations perpendicular and parallel, respectively, to the ring plane. The band 1785 A. is an overtone parallel to the ring plane. L. J. J.

Association of electron bands in solntion spectra. V. Light absorption of aliphatic and aromatic azo- and diazo-compounds. G. Kortüm (*Z. physikal. Chem.*, 1941, **B**, **50**, 361—381).—Data for absorption spectra of aq. and EtOH solutions of several azo- and diazo-compounds are discussed with reference to electromeric formulæ for the compounds based on resonance theories. C. R. H.

Analysis of absorption spectra. V. Effect of substituents at the olefinic carbon atoms on the physico-chemical properties of chromophoric vinylene and divinylene groups. E. Hertel and K. A. Hoffmann (*Z. physikal. Chem.*, 1941, **B**, **50**, 382—402).—The induced effect of substituents on the basicity, the reactivity towards MeI, and the absorption characteristics of a no. of NH_2-, NO_2-, and CN-substituted derivatives of $(CHPh:)_2$ and $(CHPh:CH)_2$ is investigated. No simple relation between absorption and the other properties appears to exist. The prep. and solubilities in org. solvents of p-*dimethylaminocinnamylidene*-, m.p. 150—151°, p-*nitrobenzylidene*-, m.p. 160—161°, and p-*nitrocinnamylidene-malononitrile*, m.p. 184°, p-*dimethylaminocinnamylidenephenylacetonitrile*, m.p. 187—188°, and p-*dimethylaminobenzylidenenitromethane*, m.p. 174°, are described. C. R. H.

Investigation of organic substances with the aid of electron excitation in the glow discharge. H. Schüler and A. Woeldike (*Physikal. Z.*, 1942, **43**, 17—22).—The ultra-violet emission spectra of PhMe, PhEt, PhPr$^\alpha$, PhPr$^\beta$, and *o*-, *m*-, and *p*-xylene excited by electron collision in a discharge tube are similar to their absorption spectra. New emission bands are found at 3900—5700 A. The spectra do not change in intensity if Kr is used instead of H_2 as the carrier of the discharge, and are therefore a primary result of the excitation of the mol. by electron collision. The various mono-derivatives of C_6H_6 give the same spectra, and two spectra, green and blue, are obtained for each substance in the visible. This is explained by supposing that these mols. can fall back from the excited state, and still leave the C_6H_5 radical excited. Purely spectroscopic data give 2·48 e.v. or 57,000 g.-cal. per g.-mol. as the upper limit of the work of separation of Me from the C_6H_6 ring. Comparison of intensities shows that the efficiency of the electron collision process depends on the positions of substituents in di-derivatives. No visible spectrum is obtained in the case of C_6H_6, PhCl, PhBr, PhOH, PhCN, or NH_2Ph, since the falling back of these mols. from the excited state does not set free sufficient energy to excite the Ph radical. A. J. M.

Reversible quenching by oxygen of the fluorescence of polycyclic hydrocarbons. H. Weil-Malherbe and J. Weiss (*Nature*, 1942, **149**, 471—472).—Differences in fluorescence intensity exhibited by 3 : 4-benzpyrene dissolved in tetralin or C_6H_{14} are attributed to the quenching effect of dissolved O_2. Other polycyclic hydrocarbons behave similarly. Self-quenching is interpreted by an elementary process: $(HC)^* + (HC) \rightarrow (HC)^+(HC)^- \rightleftharpoons (HC)_2$. A. A. E.

Loss of efficiency of strontium sulphide [phosphors]. E. Streck (*Z. physikal. Chem.*, 1940, **B**, **47**, 220—226).—The discoloration of SrS phosphors, with consequent loss of efficiency, is investigated. Pure SrS gives no coloration when irradiated with ultra-violet light or when kept in the light for several weeks. Light affects SrS–Bi phosphors if traces of H_2O are present. The effect of dry gases is investigated; only CO_2 has a slight effect, which is more marked in the presence of H_2O. The phosphor is also affected by H_2O even in the dark. The reaction occurring is $SrS + 2H_2O = Sr(OH)_2 + H_2S$; the H_2S may be oxidised and the S formed may give rise to polysulphides. The prep. of varnishes to prevent decomp. of the phosphors is discussed; they must preserve the phosphor against H_2O, and must not give rise to acids by hydrolysis. Two varnishes which satisfy these conditions are a polystyrene varnish and (better) a natural resin. A. J. M.

Application of new method of analysis of molecular spectra to saturated aliphatic hydrocarbons. H. Deslandres (*Compt. rend.*, 1941, **213**, 98—102; cf. A., 1940, I, 8, 55).—The Raman spectra of hydrocarbons C_nH_{2n+2} up to $n = 12$ are analysed by using the formula $\nu = qd_1/s'r'$ (ν = frequency, s' = no. of energised electrons, d_1 = const. = 1062, q and r' are integers). $C_{12}H_{26}$ is taken as an example. A. J. M.

Thermal energy of crystalline solids. (*a*) **Basic ideas.** (Sir) C. V. Raman. (*b*) **White phosphorus.** R. Norris. (*c*) **Lithium, tungsten, gold, silicon, and grey tin.** B. Dayal. (*d*) **Diamond.** V. B. Anand. (*e*) **Magnesium, zinc, and cadmium.** B. Dayal. (*f*) **Quartz.** R. Norris. (*g*) **Alkali halides.** C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 459—467, 468—472, 473—483, 484—491, 492—498, 499—505, 506—515).—(*a*) The thermal energy of cryst. solids is considered from the viewpoint of at. vibrations. The energy associated with elastic vibrations is negligible. Most of the energy is associated with lattice frequencies appearing as monochromatic infra-red lines. The residues with superlattice frequencies of different orders, which appear monochromatically in the far infra-red, become increasingly important at low temp. The theories of Debye and Born lack theoretical justification and observational verification.

(*b*) The sp. heat has been calc. by considering the unit cell of four P_4 mols. Of the 48 degrees of freedom, 24 are identified with internal vibrations of the P_4 mol. characterised by Raman $\nu\nu$, 12 are associated with the inactive ν of a triply degenerate rotational oscillation of each of P_4 mol., 9 with the observed low-ν vibration due to the hindered translations of P_4 mols. in the unit cell, and 3 with simple translations of the unit cell in the lattice. The Einstein terms of each have been evaluated and the calc. vals. of C_p agree well with observed vals.

(*c*) Applying the theory of (*a*) the nos. of lattice frequencies associated with body-centred cubic lattices, face-centred cubic lattices, and diamond-like structures are 1, 3, and 7, respectively. The calc. sp. heats of Li, W, Au, Si, and grey Sn agree well with experimental vals. Lattice frequencies ≃ those given by Lindemann's m.p. formula.

(*d*) The at. heat data of Pitzer (A., 1938, I, 184) agree satisfactorily with a formula containing Einstein terms corresponding with observed $\nu\nu$.

(*e*) Monochromatic Einstein frequencies must be present to

explain the shape of sp. heat curves of metals having hexagonal structure. One, the smaller, corresponds with vibrations of the atoms parallel to the hexagonal axis, and the other is associated with movements of the atoms in the basal plane. Terms corresponding with superlattice frequencies must also be included. Vals. for Mg, Zn, and Cd in good accord with experimental data are obtained.

(*f*) The Debye limiting frequency of quartz is calc., from ultrasonic-vibration data, as 189 cm.$^{-1}$ A Debye function for this limiting frequency, even after allowing for monochromatic lattice vibrations, does not agree with sp. heat data. Re-examination of Raman spectra of quartz revealed lines corresponding with superlattice frequencies of 145 and 69 cm.$^{-1}$ Inclusion of Einstein terms for these yields acceptable sp. heat vals. for the range 53—296° K.

(*g*) The character table for rock-salt, derived by group theory, gives 8 triply degenerate normal modes of vibration; 1 corresponds with translation of the cell as a whole, 2 are active in the infra-red but inactive in Raman effect, and 5 are inactive in both but their overtones appear in Raman spectra. A general expression for the thermal energy of cubic crystals, developed in terms of lattice and superlattice frequencies, gives vals. for C_p in reasonable agreement with experimental data. W. R. A.

Raman spectrum of mercuric chloride in relation to its structure. K. V. K. Rao (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 521—528).—Raman spectra of solid, liquid, gaseous, and dissolved $HgCl_2$ all contain a displacement of 314 cm.$^{-1}$ indicating that $HgCl_2$ is a non-polar, linear mol. A displacement of 377 cm.$^{-1}$ in the spectra for the solid and liquid is attributed to an overtone of the forbidden frequency. Lattice oscillations give rise to displacements of 73, 95, and 124 cm.$^{-1}$ The effects of temp. on the spectrum are discussed. W. R. A.

Effect of temperature on the intensities of Raman lines. I. Crystals. K. Venkateswarlu (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 529—534).—The intensity ratio of the Stokes and anti-Stokes lines at different temp. is investigated for quartz, $NaNO_3$, and $HgCl_2$ crystals, and agrees with that predicted by existing theories. W. R. A.

Raman effect and hydrogen bonds. I. Mixtures of esters and acceptor molecules. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 593—603).—H-bond formation between esters as donor mols. and PhOH, EtOH, MeOH, and $CHCl_3$ as acceptor mols. is studied by Raman effect, particularly changes in the C:O frequencies. Four groups are distinguished: (i) the C:O frequency is displaced; (ii) the appearance of a modified C:O frequency with the original one; (iii) diffuseness of C:O frequency; and (iv) no change. The strengths of H-bonds depend on the anionoid power of the donor and the cationoid power of the acceptor mols. W. R. A.

Raman spectra of acetylenes. VI. Δ^{α}-Butine, -pentine, and -hexine, Δ^{γ}-hexine, Δ^{δ}-octine, and α-chloro-Δ^{α}-heptine. F. F. Cleveland, M. J. Murray, and H. J. Taufen (*J. Chem. Physics*, 1942, **10**, 172—176; cf. A., 1942, I, 83).—Data are recorded for the 2200 cm.$^{-1}$ region. Δ^{α}-Butine shows a second strong line at 2158 cm.$^{-1}$, and Δ^{δ}-octine shows no line near 2245 cm.$^{-1}$ Introduction of Cl radically modifies the spectrum of Δ^{δ}-octine. L. J. J.

Raman spectra of sugars in the solid state and in solution. I. Raman spectra of α- and β-*d*-glucose. F. H. Spedding and R. F. Stamm (*J. Chem. Physics*, 1942, **10**, 176—183).—A method is described of photographing Raman spectra of cryst. org. powders and solutions of poor scattering power, involving the use of saturated $(CH_2{\cdot}CO_2H)_2$ solution and a Hg vapour absorption cell as filters for $\lambda\lambda$ <2300 A. and for λ 2537 A., respectively. 36 lines are recorded for α- and 32 for β-*d*-glucose, as well as a no. of new bands. L. J. J.

Spectrophotometric terms and symbols. Anon. (*Analyst*, 1942, **67**, 164).—Report of a Panel appointed by the Publication Committee. T. F. W.

Spectrophotometric studies. Reaction of cyanide with nitrogenous derivatives of ferriprotoporphyrin.—See A., 1942, II, 208.

Electric strength of dielectrics. (A) A. E. W. Austen and S. Whitehead. (B) A. von Hippel, R. J. Maurer, and G. M. Lee (*Physical Rev.*, 1942, [ii], **61**, 199—200, 200).—(A) A discussion of, and enquiries concerning, work reported by von Hippel (cf. A., 1941, I, 328), with reference to available data.

(B) A brief reply to the above. N. M. B.

Electric breakdown of ionic crystals. H. Fröhlich (*Physical Rev.*, 1942, [ii], **61**, 200—201).—Mathematical. von Hippel's experiments (cf. A., 1941, I, 328) confirm Fröhlich's theory of dielectric strength of ionic crystals and the behaviour of mixed crystals (cf. A., 1939, I, 551; 1941, I, 454). N. M. B.

Dipole moment and molecular structure. I. Dipole moments of ethyl esters of phenyl-substituted acetic, malonic, and glutaric acids. N. L. Phalnikar, B. V. Bhide, and K. S. Nargund. **II. Dipole moments of ethyl esters of *p*-substituted benzoic acids.** A. H. Bhatkhande, N. L. Phalnikar, and B. V. Bhide (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 48—52, 53—55).—I. Dipole moments are recorded as follows: $CH_2Ph{\cdot}CO_2Et$, 1·82 D.; $CHPhMe{\cdot}CO_2Et$, 1·818 D.; $CHPh_2{\cdot}CO_2Et$, 1·761 D.; $CHPh(CO_2Et)_2$, 2·543 D.; $CPhMe(CO_2Et)_2$, 2·52 D.; $CPh_2(CO_2Et)_2$, 4·433 D.; $CHPh(CH_2{\cdot}CO_2Et)_2$, 2·505 D.; $CPh_2(CH_2{\cdot}CO_2Et)_2$, 2·43 D.

II. Dipole moments are recorded as follows: EtOBz, 1·93 D.; p-$C_6H_4Cl{\cdot}CO_2Et$, 2·24 D.; p-$C_6H_4Br{\cdot}CO_2Et$, 2·31 D.; p-$NO_2{\cdot}C_6H_4{\cdot}CO_2Et$, 4·05 D.; p-$NH_2{\cdot}C_6H_4{\cdot}CO_2Et$, 3·41 D.; these vals. indicate that the average angle between the moment of the CO_2Et group and the C–C line is 79°. F. J. G.

Molal volume nomographs for aliphatic hydrocarbons. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 351).—From Egloff and Kuder's data (A., 1941, I, 329) nomographs relating the mol. vol. of a liquid hydrocarbon at its b.p. with its b.p. and the no. of C atoms in the mol. have been constructed. J. W. S.

Indirect estimation of critical temperature and of molar refractivity. R. Livingston (*J. Physical Chem.*, 1942, **46**, 341—343).—For members of a homologous series and over restricted ranges the crit. temp. and mol. refractivity vary linearly with b.p. C. R. H.

Optical properties of diffusing materials. S. Q. Duntley (*J. Opt. Soc. Amer.*, 1942, **32**, 61—70).—A general theory of the optical properties of non-homogeneous non-isotropic materials bounded by reflecting surfaces is developed. These properties may be defined by an equation containing eight consts., namely, two surface reflexion factors, two absorption coeffs., and four scattering coeffs. The necessary optical measurements and a graphical derivation of the optical consts. are described. The method allows complete specification of the optical properties of diffusing materials, *e.g.* plastics. O. D. S.

Dispersion of optical glass. M. Herzberger (*J. Opt. Soc. Amer.*, 1942, **32**, 70—77).—An empirical dispersion formula is developed which closely fits published data for many silicate glasses for $\lambda\lambda$ down to 2·6 μ. The formula suggests that silicate glasses have two absorption bands in the near ultra-violet, probably ~2000 and 1600 A. A more complex formula is developed for the dispersion curves of certain extraordinary glasses, *e.g.*, dense flint glasses. O. D. S.

Far ultra-violet reflectivities of metallic films. M. Banning (*J. Opt. Soc. Amer.*, 1942, **32**, 98—102).—Reflectivities of evaporated films of Al, Cu, Ag, and Be were measured spectrographically in the region 1200—2200 A. before exposure of the films to air. The reflectivity of Cu films falls on exposure to air but the other metals show no effect. The min. in the reflectivity of Be previously reported (A., 1939, I, 407) is not confirmed; it was probably due to a thin film of W evaporated over the Be surface. O. D. S.

Polarisation of light diffused by mercury vapour. R. Lennuier (*Compt. rend.*, 1941, **213**, 120—121).—Determination of the polarisation of light diffused by Hg vapour shows that the isotropy of the Hg atom is comparable with that of the inert gas atoms. A. J. M.

Rotation of the plane of polarisation by organic compounds. Optical activity of terpene compounds. Influence of solvent on the rotation of the plane of polarisation. W. Hückel [with K. Kümmerle, G. Legutke, C. Kühn, H. Niggemeyer, F. Nerdel, S. Eskola, H. Pietsch, H. Weidner, W. Doll, I. Schneider, F. Neumann, W. Tappe, and H. Sowa] (*Annalen*, 1941, 549, 95—186).—Cyclic terpenes are selected as possessing non-mobile structures, and the optical activity of camphane derivatives (camphor, *epi*camphor, fenchocamphorone, etc.) containing C:O, :CH_2, and other groupings to confer asymmetry is studied. Effects ascribed to stereoisomerism (*e.g.*, in the menthols and menthylamines), induced asymmetry in C:C bonds, the effect of primary, *sec.*, and *tert.* nature of OH groups and their attachment to primary, *sec.*, and *tert.* C atoms, are described. Kuhn's calculation of optical activity by assigning individual contributions to each centre of asymmetry is examined; it appears to be satisfactory for CO: and unsaturated compounds, of doubtful val. for saturated alcohols, and inapplicable to saturated hydrocarbons. The influence of solvent on optical activity of terpenes is discussed. General influences are difficult to trace but variation is marked among alcohols in C_6H_6 or EtOH and other solvents (PhCN, $PhNO_2$, C_6H_6, $C_{10}H_{12}$, etc.); an intimate spatial relation or a no. of alternative spatial relations between solvent and solute is assumed. A. H. C.

Modern valency formulæ and the elementary student. J. C. Speakman (*Chem. and Ind.*, 1942, 227).—Copley's rule for the abs. valency of an atom in an electronic formula (A., 1942, I, 196) is unsatisfactory. A. J. M.

Flow of energy in thermal transpiration for a Bose–Einstein and a Fermi–Dirac gas. D. V. Gogate and D. S. Kothari (*Physical Rev.*, 1942, [ii], **61**, 349—358).—Mathematical. Two chambers at different temp. are connected by an effusion orifice. The energy flow for a relativistic and non-relativistic gas is considered in the three possible cases when the chambers are assumed to contain a gas non-degenerate in both, degenerate in both, and degenerate in one and non-degenerate in the other. N. M. B.

Effusion phenomena in a degenerate Bose–Einstein gas. D. V. Gogate and Y. V. Kathavate (*Phil. Mag.*, 1942, [vii], **33**, 310—

314).—The expressions for effusion of no., mass, and energy of particles are shown to depend only on temp. in degenerate Bose–Einstein statistics, whilst in the non-degenerate case they depend on concn. as well. The effusion of a single gas between two chambers at different temp. is calc. L. J. J.

Quantum theory of the chemical bond. C. A. Coulson (*Proc. Roy. Soc. Edin.*, 1941—42, **61**, **A**, 115—139).—A survey of the mol. orbital aspect of the problem. An explanation of the Hartree theory of at. electron motion leads to an account of the normal single bond, illustrated by H_2, HCl, and H_2O, the double bond (C_2H_4 and its double-streamer orbit), and conjugated compounds (allyl, C_6H_6, and aromatic compounds). Other applications considered are rotation about a conjugated single bond, vibrations, and polymerisation. N. M. B.

Quantum mechanical calculations on the theory of organic dyes. I. T. Förster (*Z. physikal. Chem.*, 1940, **B**, **47**, 245—268).—The electronic terms of org. dye ions, and hence the λ of light they absorb, are calc. from valency theory for two types of mol.: (1) a conjugated chain with an odd no. of CH groups, and auxochrome groups (NH_2, OH, etc.) at the two ends; (2) a similar mol. but branched in the middle. The theory accounts for the observed properties of dye ions. Absorption is displaced to longer λλ with increasing length of chain, and with increasing power of the auxochrome. The connexion between constitution and chemical stability, *e.g.*, towards hydrolysis, is also satisfactorily accounted for. A. J. M.

Structure of the heteropoly-acids. B. V. Nekrassov (*J. Gen. Chem. Russ.*, 1941, **11**, 373—375).—A discussion of the structure of the phosphotungstic and phosphomolybdic acids and their salts, with special reference to the work of Keggin (A., 1934, 479) and Nikitina (A., 1941, I, 56, 88). The formula $Na_3[P(MoO_4)_4,(8-x)MoO_3],xNaHMoO_4$ is suggested as being fundamental for both sets of acids. N. G.

Electrical contact between solids. H. Y. Fan (*Physical Rev.*, 1942, [ii], **61**, 365—371).—A mathematical treatment of contact between two metals and between a metal and a semi-conductor. N. M. B.

Study of mobility spectrum of large atmospheric ions. P. Queney (*Compt. rend.*, 1941, **213**, 498—500).—Apparatus is described and numerical results of observations are tabulated. F. J. G.

Linear effect of the electric field in molecular beam investigations with ammonia. H. Scheffers (*Physikal. Z.*, 1942, **43**, 6—10).—Deviation of a mol. beam of NH_3 by an electric field is ∝ field strength; with other mols. the effect is ∝ (field strength)^2. This result requires for NH_3 a moment $\sim\frac{1}{3}$ of that deduced from accurate determinations of the dielectric const. This discrepancy is further investigated. The effect of translational and rotational motion of the mol. is discussed. Consideration of nuclear spin does not affect the result. If the solid pyramidal structure of the NH_3 mol. is accepted the discrepancy cannot be explained, but if it is supposed that the N atom can vibrate through the plane of the H atoms, the moment of the mol. is comparable with that deduced from the effect of the electric field on mol. rays. A. J. M.

III.—CRYSTAL STRUCTURE.

New casette for *X*-ray diffraction patterns.—See A., 1942, I, 212.

New method in *X*-ray crystallography.—See A., 1942, I, 212.

Quantum theory and diffuse *X*-ray reflexions. G. D. Preston (*Nature*, 1942, **149**, 373—374).—Differences in interpretation as between Raman and others regarding the origin of non-Laue diffuse reflexions are defined and briefly discussed. A. A. E.

Quantum theory and diffuse *X*-ray reflexions. M. Born, (Mrs.) K. Lonsdale, and H. Smith (*Nature*, 1942, **149**, 402—403).—Polemical (cf. preceding abstract). A. A. E.

Quantum theory and diffuse *X*-ray reflexions. M. Born (*Nature*, 1942, **149**, 403—404).—Raman's theory of the origin of extra spots on Laue photographs is contested. The spots are not contradictory to lattice dynamics, but provide a powerful method of checking it. A. A. E.

Quantum theory and diffuse *X*-ray reflexions. (Mrs.) K. Lonsdale and H. Smith (*Nature*, 1942, **149**, 404—405; cf. Pisharoty, A., 1942, I, 86).—In the diamond the "forbidden" 222 reflexion is similar to a Bragg reflexion, the {220} planes give extra reflexions, and there are no reflexions from the (200) planes of intensity comparable with that predicted. Pisharoty and Subrahmanian's contentions (*ibid.*) regarding the absence of 111 extra reflexions in type II diamonds are rejected. A. A. E.

Temperature-diffuse scattering of *X*-rays by potassium chloride and potassium bromide crystals. (Miss) J. H. Hall (*Physical Rev.*, 1942, [ii], **61**, 158—167; cf. Siegel, A., 1941, I, 195).—Cu *Kα* radiation is used, and the displacement of the temp.-diffuse max. from the Bragg scattering angle is determined for various settings of the crystal near the 400, 420, and 440 Bragg reflexions. The theoretical displacement curve for KCl, calc. from the relative effects of the α_1 and α_2 λ at the angles of incidence used, agrees well with experiment. Half-widths and relative intensities found experimentally are corr. for the vertical divergence of the slit system. An attempt is made to determine the elastic consts. of KBr from diffuse scattering data. N. M. B.

***X*-Ray interference in partially-ordered layer lattices.** S. Hendricks and E. Teller (*J. Chem. Physics*, 1942, **10**, 147—167).—Mathematical. The effect of lattice irregularities on intensity and sharpness of *X*-ray patterns is calc. for different types of irregularity in layer lattices. The results obtained are applied to partially ordered stacking of layers in micas, and to irregularities in close-packed structures of spheres and in graphite. L. J. J.

New concepts of the solid state. (Sir) C. V. Raman (*Current Sci.*, 1942, **11**, 85—92).—A lecture. W. R. A.

Structure of evaporated films of chromium and aluminium on glass. (Miss) A. R. Oliver (*Physical Rev.*, 1942, [ii], **61**, 313—314).—Electron-diffraction study of films of Al on glass, and of Al on Cr deposited on glass, shows no indication of the nature of the hardening produced in Al films by using a Cr base or by washing with H_2O (cf. Sabine, A., 1939, I, 407). The oxide film on Al, if present, is very thin and amorphous. N. M. B.

***X*-Ray study of selenium in the liquid and colloidal states.** K. Das Gupta and S. R. Das (*Indian J. Physics*, 1941, **15**, 401—409).—*X*-Ray diffraction by liquid Se from 220° to 430° reveals a single broad band with band spacing > for amorphous varieties. Band spacing increases with rise of temp. and gives a similar curve to $\rho^{\frac{1}{3}}$, when plotted against temp. Colloidal Se is stable at 100° for several hr. but when allowed to evaporate yields a sticky mass. The *X*-ray diffraction (i) of coagulum slowly coagulated indicates a sharp monoclinic pattern, (ii) of rapidly coagulated ppt. gives broad bands, (iii) of the sticky mass from evaporated sol gives one broad band with spacing 4·07 A., the same as for liquid Se near its m.p. but 0·57 A. > that in amorphous Se. It is concluded that similar arrangements of atoms exist in liquid and colloidal Se. W. R. A.

Lattice spacings and crystal structure of cementite. W. Hume-Rothery, G. V. Raynor, and A. T. Little (*Iron & Steel Inst.*, March, 1942, *Advance copy*, 7 pp.).—Cementite isolated from three steels by electrolytic dissolution of the Fe in HCl is found by *X*-ray examination to have an orthorhombic structure with *a* 4·5155, *b* 5·0773, *c* 6·7265 A. at 25°. It may be formed from martensite by simple shear in the central layer of a block of three superimposed cubes, the top and bottom layers being displaced relative to each other by ~0·5*a* in the [100] direction, and by subsequent minor adjustments of angles and distances with expulsion of certain C atoms to just inside or outside the plane of Fe atoms. A. R. P.

Structures of complex fluorides. Ammonium hexafluosilicate-ammonium fluoride, $(NH_4)_2SiF_6,NH_4F$. J. L. Hoard and M. B. Williams (*J. Amer. Chem. Soc.*, 1942, **64**, 633—637).—From *X*-ray investigation the structure is D_{4h}^5—*P*4/*mbm*, which is an ordered aggregate of NH_4^+, octahedral SiF_6'', and "extra" F′ ions. Parameters are deduced, and their vals. are discussed in relation to crystal stability. W. R. A.

Chromic oxide hydrates. II. S. I. Djatschkovski and V. M. Ofitzerov (*J. Gen. Chem. Russ.*, 1941, **11**, 371—372; cf. A., 1941, I, 19).—The changes in % of H_2O, colour, and *X*-ray diffraction pattern of Cr_2O_3 hydrate are followed when this is heated to temp. varying from 250° to 850°. The temp. of transition from brown amorphous $Cr_2O_3,4H_2O$ to light green cryst. Cr_2O_3 is between 400° and 450°. The hydrate can exist only in the amorphous colloidal state. Cryst. Cr_2O_3 has an interplanar spacing of 5·33 A. N. G.

Determination of parameters in potassium dihydrogen arsenate and silver arsenate. L. Helmholz and R. Levine (*J. Amer. Chem. Soc.*, 1942, **64**, 354—358).—The *X*-ray structures of KH_2AsO_4 and Ag_3AsO_4 are determined. The As—O distances in both are 1·75 A. The Ag—O distance of 2·34 A. is discussed in relation to the colours of Ag_3AsO_4, Ag_3PO_4, Ag_2SO_4, and Ag_2O. Random distribution of H_2AsO_4' ions and its influence on the determination of parameters of KH_2AsO_4 are discussed. The H-bond distance (O—H—O) is 2·54 A., equal to that in Ag_3PO_4. W. R. A.

***X*-Ray analysis of some organic compounds.** R. H. Joshi and M. R. Kapadia (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 35—39).—NHPhAc has *a* 7·95, *b* 9·48, *c* 19·56 A., with 8 mols. in the unit cell, space-group Q_h^{15}. NPhMeAc has *a* 6·56, *b* 7·06, *c* 16·56 A., with 4 mols. in the unit cell. *p*-OMe·C_6H_4·NHAc has *a* 24·4, *b* 9·08, *c* 7·54 A., with 8 mols. in the unit cell, space-group Q_h^{15}. F. J. G.

Crystal structure of diphenylselenium dichloride. J. D. McCullough and G. Hamburger (*J. Amer. Chem. Soc.*, 1942, **64**, 508—513).—Orthorhombic crystals of $SePh_2Cl_2$ have space-group symmetry D_{2h}^{15}—*Pbca*, 8 mols. per unit cell, a_0 7·59, b_0 17·97, c_0 17·77, all ±0·03 A., *i.e.*, the same as for $SePh_2Br_2$ (A., 1941, I, 196). The Se—Cl distance is 2·30±0·05 A. and the Cl–Se–Cl angle is 180±5°. W. R. A.

Micellar structure and deformation processes in fibrous materials. IX. Supra-molecular structure of cellulose hydrate. Introduction of laminar micelles into the theory of deformation processes. B. Baule, O. Kratky, and R. Treer (*Z. physikal. Chem.*, 1941, **B**, **50**, 255—297).—Consideration of the properties, *e.g.*, mobility and crystallisation tendency, of thread-like mols. throws light on the changes, *e.g.*, micellar formation, which may occur during pptn. A modified theory based on deformable elongated laminar micelles is discussed and developed mathematically. C. R. H.

Long *X*-ray diffraction spacings of collagen. R. S. Bear (*J. Amer. Chem. Soc.*, 1942, **64**, 727).—The structural period for large fibre-axis collagenous tissues from dried beef tendon is 640 A. W. R. A.

***X*-Rays and stoicheiometry of proteins with special reference to the structure of the keratin-myosin group.** W. T. Astbury (*J.C.S.*, 1942, 337—347).—A lecture.

Extra spots in electron diffraction patterns. A. Charlesby and H. Wilman (*Nature*, 1942, **149**, 411—412).—Apparently anomalous features in certain electron-diffraction patterns are now found to correspond closely with *X*-ray extra spots. Streaks given by anthracene crystals indicate that the mols. vibrate with max. amplitude at right angles to their length. A. A. E.

Resistivity of antimony-tin single crystals at low temperatures. C. T. Lane and W. A. Dodd (*Physical Rev.*, 1942, [ii], **61**, 183—186; cf. A., 1942, I, 169).—Resistivity-temp. curves are plotted for single crystals of pure Sb and alloys of Sb with 0—3 at.-% Sn in the temp. range 300—4·2° K. Crystals were oriented so that the [111] plane was perpendicular to the electric field. Resistivity decreases normally as temp. is lowered, but the average temp. coeff. of resistance between 4·2° and 77·3° K. decreases sharply with increasing Sn content to a small const. val. at 3 at.-% Sn. Addition of Sn at room temp. only slightly changes resistivity, but the effect at liquid-He temp. is very large. "Residual" resistivity is approx. a parabolic function of [Sn]. Results are compared qualitatively with Bloch's theory. N. M. B.

Phenomena of conical refraction. (Sir) C. V. Raman (*Current Sci.*, 1942, **11**, 44—46).—Conical refraction by a crystal of $C_{10}H_8$ is discussed. W. R. A.

Optical properties of crystals of conicine hydrochloride. J. Jaffray (*Compt. rend.*, 1941, **213**, 132—133).—The crystals are orthorhombic, and investigation of birefringence shows that they are uniaxial at 6160 A. at room temp. A. J. M.

Transition state theory of diffusion in crystals. R. M. Barrer (*Trans. Faraday Soc.*, 1942, **38**, 214).—Correction (cf. A., 1942, I, 199). F. L. U.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Determination of mol. wt. of macromolecular substances. VIII. Distribution function of multimolecular substances and its determination by fractionation. G. V. Schulz (*Z. physikal. Chem.*, 1940, **B**, **47**, 155—193).—Expressions are derived for mean mol. wt. on the basis of frequency distribution, mass distribution, and integral distribution; corresponding distribution functions are defined. The distribution function of a multimol. substance can be determined by separation into fractions of decreasing solubility and increasing ease of pptn. with increasing mol. wt. The sources and limits of error in fractionation methods of determining mean mol. wt. and the degree of variation of mol. wt. in a multimol. substance are discussed theoretically. L. J. J.

Magnetism of strontium. S. R. Rao and (Miss) K. Savithri (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 584—592).—The sp. magnetic susceptibility of Sr, determined by the Curie method, is $1·02 \times 10^{-6}$ at 0°, $1·09 \times 10^{-6}$ at 65°, and thereafter decreases to $0·73 \times 10^{-6}$ at 260°. The significance of these results from the Fermi distribution of energy of the valency electrons is discussed. W. R. A.

Magnetic susceptibilities of metal oxides and their molecular structures with special reference to those of cobalt. S. S. Bhatnagar, B. Prakash, and M. A. Qayyum (*J. Indian Chem. Soc.*, 1941, **18**, 540—554).—The magnetic susceptibilities of CoO, Co_3O_4, and Co_2O_3 and their variation with temp. are determined with specimens prepared by different methods, and concordant vals. of χ are obtained for all three oxides. The vals. of the Bohr magneton nos. are utilised in a discussion of the mol. constitution of the oxides. The effect on χ of adsorption of O_2 by CoO is examined. Very slight amounts of impurity completely vitiate conclusions drawn from magnetic measurements. F. L. U.

Magnetic susceptibilities of *cis*- and *trans*-decalin. W. Byerly and P. W. Selwood (*J. Amer. Chem. Soc.*, 1942, **64**, 717—718).—$\chi_{sp.}$ are (*cis*) $-0·774$ and (*trans*) $-0·779 \times 10^{-6}$. The slight difference is considered to be significant and indicative of the greater paramagnetism arising from the more distorted *cis*-structure. W. R. A.

Diamagnetic susceptibility of butyl alcohols. B. Cabrera and (Mlle.) H. Colson (*Compt. rend.*, 1941, **213**, 108—111).—There are small but definite differences in the vals. of χ for the four BuOH isomerides. These probably arise from a deformation of the C atom due to substitution of Me for an attached H, the resulting increase in χ being independent of the positions of the H substituted. General dissymmetry of the mol. may also produce an increase in χ. A. J. M.

Temperature and frequency effects on ultrasonic velocities in carbon dioxide. C. J. Overbeck and H. C. Kendall (*J. Acoust. Soc. Amer.*, 1941, **13**, 26—32).—Ultrasonic velocity in pure CO_2 is measured from 25° to 530°, with $\nu\nu$ from 27 to 147 kc. Earlier discrepancies are ascribed to impurities and temp. gradients. Velocity depends on temp. and ν, and the variation with ν is greater at high temp. O. D. S.

Origin of the absorption of ultrasonic waves in liquids. K. F. Herzfeld (*J. Acoust. Soc. Amer.*, 1941, **13**, 33—35).—Theoretical. The absorption coeff. of ultrasonic waves in H_2O, C_6H_6, CCl_4, and MeOH is $\propto \nu^2$ for $\nu\nu$ up to 50 Mc. but is $>$ expected from viscosity and heat conduction of the liquids. The hypothesis that the high absorption is due to a slow energy exchange between internal and external degrees of freedom agrees with the data for all except H_2O. O. D. S.

Absorption of ultrasonic waves in highly viscous liquids. J. L. Hunter (*J. Acoust. Soc. Amer.*, 1941, **13**, 36—40).—The absorption coeff. of ultrasonic waves in glycerol, castor oil, linseed oil, and olive oil at temp. from 0° to 50° and $\nu\nu$ 3·157 and 3·95 Mc. is measured with Fox's apparatus (A., 1938, I, 20). Vals. exceed those calc. from the viscosity and heat conduction of the liquids but the difference is $>$ experimental error. The temp. coeff. agrees with the val. calc. from viscosity and heat conduction. O. D. S.

Supersonic measurement of the heat capacity of propylene. D. Telfair (*J. Chem. Physics.*, 1942, **10**, 167—171).—C_v vals. from 12·30 g.-cal. per mol. at 270° K. to 21·00 g.-cal. per mol. at 510° K. are recorded, obtained by acoustical velocity measurements in C_3H_6 by means of a Pierce acoustic interferometer used well on the low-ν side of the intramol. dispersive region. Max. absorption would occur at 80—100 Mc., corresponding with a relaxation time $\sim 10^{-8}$ sec. The vals. obtained agree with an assumed potential restricting rotation $\sim$2000 g.-cal. per mol. L. J. J.

Resonance method of measuring the ratio of the specific heats of a gas, C_p/C_v. III. Sulphur dioxide and nitrous oxide. A. L. Clark and R. Katz (*Canad. J. Res.*, 1941, **19**, **A**, 111—115; cf. A., 1940, 1, 248, 271).—By the method previously described, the vals. of γ for SO_2 and N_2O have been found to follow the relations $1·2642 + 0·0169P + 0·0026P^2$ and $1·2783 + 6·320 \times 10^{-3}P + 1·22 \times 10^{-4}P^2 + 6·80 \times 10^{-8}P^4$, respectively, where P = pressure in atm. J. W. S.

Heat capacities of red and yellow lead monoxides at high temperatures. H. M. Spencer and W. M. Spicer (*J. Amer. Chem. Soc.*, 1942, **64**, 617—621).—An aneroid calorimeter is described. Heat contents and vals. of C_p for yellow and red PbO are given. W. R. A.

Phase transitions. I. Heat capacity of nickel nitrate hexammoniate from 54° to 300° K. Transition at 243° K. E. A. Long and F. C. Toettcher (*J. Amer. Chem. Soc.*, 1942, **64**, 629—632).—C_p for $Ni(NO_3)_2(NH_3)_6$ (I), determined from 54° to 300° K., has max. val. at 243·3°. There is a gradual transition from 173° to 247°, the heat of transition being 1818 g.-cal. per mol., and the corresponding entropy is $7·65 \pm 0·5$ entropy units. There is an additional region of anomalous thermal behaviour at $<80°$ K. The transition at 243° is discussed from the viewpoint of order-disorder in the orientation of NO_3 groups in the crystal lattice. W. R. A.

System correlating molecular structure of organic compounds with their b.p. VI. Monohalogen derivatives of the hydrocarbons. C. R. Kinney (*J. Org. Chem.*, 1942, **7**, 111—116; cf. A., 1939, 1, 134).—Observed b.p. of 437 organohalides show an average deviation of 4·18° from the vals. calc. from the equation, b.p. $= 230·14 \times (\text{b.p. no.})^{1/3} - 543$, in which b.p. no. for the mol. is obtained by summing the at. and structural b.p. nos. for the various atoms and structural groups in the mol. Different b.p. nos. must be assigned to primary, *sec.*, and *tert.* halogen and structural differences in the arrangement of the C atoms must be considered. Characteristic b.p. nos. are assigned to halogen attached to doubly or trebly linked C. Until more reliable data are available the influence of *cis.–trans*-isomerism on the b.p. nos. of halogens cannot be assessed. For alicyclic halides the same b.p. nos. for the halogens are used as in analogous open-chain derivatives. Unusually high b.p. are always observed for unsubstituted alicyclic halides, $R\cdot[CH_2]_n\cdot X$, in which R is a further unsubstituted alicyclic ring and n may be any integer or 0, and for the similarly constituted di*cyclo*-derivatives $R[CH_2]_2R$. This structure seems to affect the b.p. uniformly. Characteristic b.p. nos. are used for halogen attached to the C_6H_6 or $C_{10}H_8$ rings; these give satisfactory results regardless of the presence or absence of alkyl groups. The best agreement is obtained with fluorides and chlorides. H. W.

Freezing point of phenothiazine. L. E. Smith and O. A. Nelson (*J. Amer. Chem. Soc.*, 1942, **64**, 461—462).—Phenothiazine, prepared by sublimation, has f.p. 185·11±0·02°. W. R. A.

Entropy of vaporisation and density of liquids at their b.p. J. H. Simons and R. K. Smith (*J. Physical Chem.*, 1942, **46**, 380—387).—The total entropy of vaporisation (ΔS) is considered as being the sum of the entropy of conversion of liquid into perfect gas (ΔS_c) and the entropy of gaseous expansion (ΔS_x). Vals. of ΔS, ΔS_c, and ΔS_x for 126 substances are tabulated, and empirical equations connecting ΔS with b.p. are discussed. C. R. H.

Vapour pressure of monatomic vapours. R. W. Ditchburn and J. C. Gilmour (*Rev. Mod. Physics*, 1941, **13**, 310—327).—Methods of measurement of the v.p. of monat. vapours from 10^{-8} to 10^3 mm. are discussed critically. The theoretical significance of such measurements is indicated. Published data for the v.p. of monat. vapours are correlated and discussed critically. The best vals. are tabulated. O. D. S.

Vapour pressure and vapour density measurements on gallium trichloride. W. Fischer and C. Jübermann (*Z. anorg. Chem.*, 1940, **245**, 254—256; cf. A., 1936, 787).—A reply to Laubengayer and Schirmer (A., 1940, I, 369). J. W. S.

Vapour pressure and critical constants of *iso*butene. J. A. Beattie, H. G. Ingersoll, and W. H. Stockmayer (*J. Amer. Chem. Soc.*, 1942, **64**, 546—548).—The v.p. of *iso*-C_4H_8, measured from 30° to 125°, is satisfactorily represented by $\log p$ (atm.) = 4·3759 − 1163·34/T. Crit. consts. are determined by the compressibility method: θ_c = 144·73±0·05° c.; p_c = 39·48±0·05 normal atm.; v_c = 0·240 l. per mol.; ρ_c = 4·17 mols. per l. W. R. A.

Vapour pressures of tritium liquid hydrogens. Dependence of hydrogen vapour pressure on mass of molecule. W. F. Libby and C. A. Barter (*J. Chem. Physics*, 1942, **10**, 184—186).—Distillation and radioactivity measurements on the distillate gas from ~10^{-9}M. solutions of HT in H_2 and DT in *n*-D_2 give the following vals. for v.p. of the different kinds of mol. at 20·4° K., as derived from Henry's law consts. assuming H_2 and D_2 to form nearly perfect solutions: H_2 760 mm., HD 438 mm., D_2 256 mm., HT 254±16 mm., DT 123±6 mm., T_2 45±10 mm. L. J. J.

Joule–Thomson effect in carbon dioxide. J. R. Roebuck, T. A. Murrell, and E. E. Miller (*J. Amer. Chem. Soc.*, 1942, **64**, 400—411).—Iso-enthalpic curves of CO_2 are measured between −55° and 300° and between 1 and 200 atm. The Joule–Thomson coeff. is calc. as a function of temp. at a series of const. pressures. The inversion curve in the liquid region and the contact point of a particular isenthalp with the v.p. curve are located. W. R. A.

Compressibility of and an equation of state for gaseous *iso*butene. J. A. Beattie, H. G. Ingersoll, and W. H. Stockmayer (*J. Amer. Chem. Soc.*, 1942, **64**, 548—549).—The compressibility of gaseous *iso*-C_4H_8 is measured from 150° to 275° and from ρ = 1·0 to 9·0 mols. per l., the max. pressure being 250 atm. The consts. of an equation of state are determined from the data up to crit. ρ, and vals. of the second virial coeff. are given from 150° to 275°. In a glass-lined bomb *iso*-C_4H_8 does not polymerise markedly during a 10-hr. period until 275° is reached. W. R. A.

Variation of viscosity of liquids with temperature. M. K. Srinivasan and B. Prasad (*Phil. Mag.*, 1942, [vii], **33**, 258—271).—Known viscosity data are used to compare the applicability of a no. of published formulæ connecting η and temp., for a no. of org. liquids and liquid metals. The best for unassociated liquids is Andrade's simple formula $\eta = Ae^{b/T}$, which is as accurate as the modified formula $\eta v^{\frac{1}{3}} = Ae^{c\epsilon/T}$. For liquid metals, $\eta v^{\frac{1}{3}}/\sqrt{T} = B/(v - v_0)$ (Macleod), $\eta = K^{\frac{1}{2}}vT^{-\frac{1}{2}}e^{Q/RT}$ (Silverman), and $\eta = Ae^{\beta T}/(T - b)$ (Madge) hold, though the last is theoretically unsound. For org. liquids, Silverman's and Madge's formulæ are applicable. Irany's function of η is not linear for liquid metals. L. J. J.

Effect of laminar and turbulent flow on *X*-ray diffraction diagrams of water and nitrobenzene. W. R. Dubs (*Z. Ver. deut. Ing.*, 1941, **85**, 50—52).—The Debye–Scherrer patterns of jets of H_2O and $PhNO_2$ in free air are studied. The degree of stability (laminar or turbulent flow) of a jet ~0·81 mm. in diameter is determined from corresponding experiments with coloured filaments on a model 11 times the scale. The laminar resistance law still holds when the filaments depart appreciably from strictly laminar flow. Diffraction diagrams showed no effect definitely attributable to change from laminar to turbulent flow. Small effects in intensity distribution noted in the case of $PhNO_2$ can be attributed to temp. changes accompanying change of type of flow. There is no evidence of any change in the quasi-cryst. structure with breakdown of laminar flow. R. B. C.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Graph for preparing binary systems of approximate mol. fractions. W. Byerly (*J. Chem. Educ.*, 1941, **18**, 465). L. S. T.

Volatility of silicic acid in steam.—See B., 1942, I, 249.

Apparent volumes of individual ions in aqueous solution. K. Fajans and O. Johnson (*J. Amer. Chem. Soc.*, 1942, **64**, 668—678).—A partition of the apparent mol. vol. (Φ_0) of strong electrolytes into vals. of individual ions has been made on the basis of the behaviour of NH_4Cl near 35°. Vals. of Φ_0 for electrolytes have been obtained by extrapolation from measurements of ρ at >N. Near 35° NH_4Cl closely resembles H_2O in several properties and it is concluded that NH_4^+ and Cl' ions fit into the structure of liquid H_2O and that the apparent vol. of each is equal to the vol. of 1 mol. of H_2O. For ions which are larger or smaller than H_2O mols. the thermal expansibility of their aq. solutions is influenced greatly by the breaking of the loose H_2O structure. Displacement of protons within H_2O mols. and H_3O^+ and NH_4^+ ions is brought into relation with the mechanism of hydration of ions and mols. Comparison of anions with cations and of ions of different structures shows that the gradation of their apparent vols. in aq. solution may be very different from that of their size in crystals. W. R. A.

Densities and specific heats of aqueous solutions of *dl*-α-alanine, β-alanine, and lactamide. F. T. Gucker, jun., and T. W. Allen (*J. Amer. Chem. Soc.*, 1942, **64**, 191—199).—Vals. of sp. heats and of ρ for aq. solutions of lactamide (I), *dl*-α-alanine (II), and β-alanine (III) have been determined from 0·1 or 0·2M. to approx. saturated solution at 5°, 25°, and 40°. The apparent molal heat capacities of solutes at concn., and the slopes increase in the order (I), (II), (III). Vals. at infinite dilution are (I) > (II) by 25 and > (III) by 40 g.-cal. per degree per mol. Apparent molal vol. at molarity and the limiting val. of (I) is > that of (II) by 12·90 and > that of (III) by 14·78 ml.; these vals. are considered to be the electrostriction of the solvent. The limiting slopes of the partial molal heat capacities and vols. for (II) and (III) have been calc. The calc. differences in the heat capacities and vols. at different temp. are ~½ of those observed. W. R. A.

Specific heats of morpholine and its aqueous solutions. H. M. Trimble, C. J. Engle, R. A. Brown, and R. F. Schmuck (*J. Amer. Chem. Soc.*, 1942, **64**, 679—681).—The sp. heats of morpholine and its aq. solutions between 0° and 130° and between 0 and 100% H_2O have been determined, and the partial molal heat capacities of the components of the system have been calc. at 25°, 50°, 75°, 100°, and 130°. W. R. A.

Diffraction pattern of sulphuric acid at different concentrations. H. N. Bose (*Indian J. Physics*, 1941, **15**, 411—415).—*X*-Ray diffraction of aq. H_2SO_4 (21·4—99·2 wt.-% H_2SO_4) has been measured with a view to establishing hydrate formation. Pure H_2SO_4 gives two sharp bands with spacings of 4·07 and 7·98 A., of which the former is more pronounced. With dilution the spacing diminishes from 4·07 to 3·6 A. for H_2SO_4,H_2O, and for all concns. is between 4·07 and 3·24 A., the val. for H_2O. The possible existence of hydrates and the application of the idea of Lennard-Jones relating band-spacing and particle size are discussed. W. R. A.

Light absorption of cobalt thiosulphate solutions.—See A., 1942, I, 194.

Electric moments of inorganic halides in dioxan. I. Phosphorus, arsenic, and antimony trihalides. P. A. McCusker and B. C. Curran (*J. Amer. Chem. Soc.*, 1942, **64**, 614—617).—Vals. of dielectric const. (ϵ) and ρ for dioxan solutions of PCl_3, PBr_3, $AsCl_3$, $AsBr_3$, AsI_3, $SbCl_3$, and $SbBr_3$ have been measured at various concns. (c) at 25°. The $\Delta\epsilon/c$ ratios for PCl_3 and PBr_3 decrease with increasing solute concn. Vals. of μ are $AsCl_3$ 3·11, $AsBr_3$ 2·90, AsI_3 1·83, $SbCl_3$ 5·16, $SbBr_3$ 5·01 D. W. R. A.

Magnetic rotation of cerium salts in aqueous solutions. W. K. Wilson, C. M. Mason, J. W. Hickey, and J. H. Mack (*J. Amer. Chem. Soc.*, 1942, **64**, 412—416).—The magnetic rotation and n of aq. $CeCl_3$ have been determined at 10° intervals from 20° to 50° and up to 2·753M. Verdet consts. at concn. and temp. Mol. rotations show variation with concn. but are const. at low concn. The vals. recorded by Slack *et al.* (A., 1934, 1293) are disproved. W. R. A.

Solid solutions of alkali halides. A. V. Tobolsky (*J. Chem. Physics*, 1942, **10**, 187—192).—*X*-Ray studies of solid solutions of alkali halide pairs with a common ion at room temp. and at 550° show that the miscibility is determined by the difference (δ) between their lattice parameters. For δ <6% miscibility is complete at room temp. For δ 6—13% miscibility is complete at 550°, whilst for δ >13% two phases result for all temp. up to the m.p. On the basis of the Born theory of ionic lattices, free energy of mixing, and Vegard's law, the expression $9\delta^2/T(1 - 2x) + \log_e x - \log_e(1 - x) = 0$ is derived for the mol. fraction (x) of one component dissolved by the other in a typical alkali halide pair with electrostatic energy 180 kg.-cal. per mol. at 0° K. Miscibility is complete above T = 4·5δ^2 and the heat of mixing is ~−9δ^2 g.-cal. per mol. L. J. J.

Cation field strengths and their relation to the devitrification, combination, and m.p. of silicates. A. Dietzel (*Z. Elektrochem.*, 1942, **48**, 9—23).—If the field strength of a cation be defined as z/a^2 (z = valency, a = cation–anion distance), the cations which

are important in glass technology can be usefully arranged in a series of increasing z/a^2, viz., K (=0·13) < Na < Li < Ba < Pb < Sr < Ca < Mn < Fe^{II} < Zn < Mg < Zr < Be < Fe^{III} < Al < Ti < B < Si < P (=2·1). The relation between z/a^2 and the tendency to devitrification is discussed. Large differences between z/a^2 for the foreign cation and z/a^2 for Si^{IV}, B^{III}, or P^{V} make for stable binary systems. Ternary systems are possible where $\Delta z/a^2$ for the two primary cations is >0·05. Where $\Delta z/a^2$ is <0·05 eutectics or mixed crystals are formed. The val. of $\Delta z/a^2$ affords an indication of whether ternary compounds are likely; *e.g.*, they would not be expected in the system Li_2O–BaO–SiO_2 where $\Delta z/a^2_{LiBa} = 0·015$; on the other hand they would be expected in the system Li_2O–K_2O–SiO_2 where $\Delta z/a^2_{LiK} = 0·10$. The greater is the val. of $\Delta z/a^2$, the larger is the no. of possible ternary systems. The greatest degree of combination ($y_{max.}$) of a metallic oxide with SiO_2 (no. of mols. of SiO_2 per 1/*n* mol. of R_mO_n) can be represented by $y_{max.} = (0·36a^2/z) + C$. If $C \sim 0$ the compound melts congruently; if $C = 0·3$—0·5 it melts incongruently. With the exception of K, which ought to form $K_2O,3SiO_2$, the binary systems examined conform to the requirements of the formula. The formula is applicable to ternary systems, the $y_{max.}$ vals. for each cation being added together. The relation between $y_{max.}$ and m.p. is discussed. C. R. H.

Magnesium and its alloys.—See B., 1942, I, 272.

Solubility of aluminium in mercury. W. Klemm and P. Weiss (*Z. anorg. Chem.*, 1940, **245**, 285—287).—The solubility of Al in Hg at 422—595° has been redetermined. The results confirm those of Smits and de Gruyter (A., 1921, ii, 371) and indicate that no compound is formed but that Hg and Al form a eutectic system with eutectic composition of very low Al content. J. W. S.

Effect of small iron and silicon contents on the magnetic susceptibility of aluminium. P. Weiss and W. Klemm (*Z. anorg. Chem.*, 1940, **245**, 288—294).—The magnetic susceptibility (χ) of Al is increased only slightly when the Fe content is increased from 0·11 to 3·22%, so determination of the Fe content from χ determinations is impossible. For the Al-rich limit of the θ ($FeAl_3$) phase $\chi = +1 \times 10^6$, and the data obtained suggest that this phase extends to higher Al contents than hitherto believed. Increase in the Si content from 0·05 to 1·19% decreases the χ of Al very slightly. J. W. S.

Ternary alloy system : aluminium–lead–silver. A. N. Campbell, L. Yaffe, W. G. Wallace, and R. W. Ashley (*Canad. J. Res.*, 1941, **19, B**, 212—230).—The system has been studied by thermal analysis followed by chemical analysis of the separated layers. The region of partial miscibility extends from the binary system Al–Pb to alloys containing >85·58% of Ag and 4·71% of Pb. No ternary compounds are formed and the ternary eutectic almost coincides with the eutectic of the system Ag–Pb. J. W. S.

Solubility of a hydrogen–nitrogen mixture in liquid carbon dioxide. I. A. Abdulaev (*J. Appl. Chem. Russ.*, 1941, **14**, 302—304).—The solubility of a $3H_2 + N_2$ mixture (**I**) was investigated at 0°, 10°, and 20° and at pressures varying from 20 to 203 atm. The solubility of (**I**) in liquid CO_2 rises with increasing temp. at const. pressure and with increasing pressure at const. temp. N. G.

Solubility of carbon disulphide vapour in body fluids and tissues.—See A., 1942, III, 417.

Solubility of stannous oxide in perchloric acid. M. Gorman and P. A. Leighton (*J. Amer. Chem. Soc.*, 1942, **64**, 719—720).—The solubility of SnO in $HClO_4$ is the same as in HCl for concns. up to 0·04M-acid and 0·017M-Sn^{II}. W. R. A.

Distribution of benzoic acid between water and benzene. F. T. Wall (*J. Amer. Chem. Soc.*, 1942, **64**, 472—473).—The distribution const. $K_1 = C_W/C_B^{1/2}$ (C_W = concn. of BzOH in H_2O; C_B = concn. of BzOH in C_6H_6) is modified to $K_2 = C_W(1-\alpha)/\sqrt{\{C_B(I-\beta)\}}$ where α is the degree of ionisation of BzOH and β is the degree of dissociation of dimerides. This equation fits experimental data very satisfactorily. W. R. A.

Adsorption of dihydroxybenzenes by sugar charcoal. Discontinuities in the adsorption of phenol, resorcinol, and quinol from aqueous solutions. K. D. Jain and J. B. Jha (*J. Indian Chem. Soc.*, 1941, **18**, 535—539; cf. A., 1941, I, 255).—Data are tabulated for the adsorption of PhOH, *o*-, *m*-, and *p*-cresol, *m*- and *p*-$C_6H_4(OH)_2$ on sugar C from aq. solutions. The cresols give regular curves, whilst the others show periodic max. and min. F. L. U.

Reactions of solids. CXXV. Sintering phenomena in copper powders as revealed by their adsorptive power towards dissolved dyestuffs. J. Hampel (*Z. Elektrochem.*, 1942, **48**, 82—84).—Max. adsorption by Cu powder of Congo-red from MeOH solutions and of eosin, methylene-blue, and rhodamine from aq. solutions takes place at ~200°. As temp. increases above 200° adsorption decreases fairly regularly except for a period of const. adsorption at ~400—500°. Below 200° adsorption is more irregular, with a tendency towards min. adsorption at 100—150° which is very pronounced in the case of eosin. The data are discussed on the basis of Hüttig's theory. The adsorption is divided into six ranges corresponding with alternate activation and deactivation with rise of temp. as a result of changes in mol. grouping on the Cu surface at lower temp. and in the crystal interior at higher temp. C. R. H.

Reproducible contact angles on reproducible metal surfaces. I. Contact angles of water against silver and gold. F. E. Bartell and P. H. Cardwell (*J. Amer. Chem. Soc.*, 1942, **64**, 494—497).—Solid surfaces with reproducible properties have been prepared by vaporising the solid in a vac., condensing the vapours as a film on a supporting medium, and by controlling adsorption. The max. advancing H_2O contact angle was 95±0·5° for Ag and 92·5±0·5° for Au and the corresponding max. receding angles were 38±1° and 34±1°. Adsorption of air on the surfaces made them more hydrophobic and relatively large max. advancing angles were obtained. W. R. A.

Direct measurement of the spreading pressures of volatile organic liquids on water. L. F. Transue, E. R. Washburn, and F. H. Kahler (*J. Amer. Chem. Soc.*, 1942, **64**, 274—276).—Using a modification of the direct method (A., 1940, I, 356) the spreading pressures of *iso*-C_5H_{11}·OH, C_6H_6, PhMe, and COPhMe have been measured. Vals. of γ, interfacial tensions of the org. liquid–H_2O interface, and spreading coeffs. have been measured for each liquid. W. R. A.

High-mol. wt. aliphatic amines and their salts. V. Soluble and insoluble films of the amine hydrochlorides. E. J. Hoffman, G. E. Boyd, and A. W. Ralston (*J. Amer. Chem. Soc.*, 1942, **64**, 498—503).—The variation of γ of solutions of $C_{12}H_{25}$·NH_2,HCl with concn. has been investigated at various temp. by the ring method and at < the crit. concn. for micelle formation. Time effects of long duration were encountered. Insol. monolayers of $C_{18}H_{37}$·NH_2,HCl on various sub-solutions become more expanded with increase in temp. and also with increase in the size of the anion. The behaviour of O-acid salts of $C_{18}H_{37}$·NH_2 has been studied. W. R. A.

Membrane permeability. HI. Preferential ionic permeability of membranes of cupric ferrocyanide and of parchment. G. M. Willis (*Trans. Faraday Soc.*, 1942, **38**, 169—179).—E.m.f. of the cell $S|$electrolyte $c_1|$membrane$|$electrolyte $c_2|S$, in which *S* is a saturated Hg_2Cl_2 electrode, were measured for different vals. of c_1 and c_2, the ratio c_1/c_2 being always 10. The apparent mobilities of anions in their K salts for membranes of $Cu_2Fe(CN)_6$ are in the order $Br' > NO_3' > Cl' > I' > CNS'$; $SO_4'' > C_2O_4'' > Fe(CN)_6''''$ (=0), and are quite unrelated to their mobilities in free solution. This order is the same as for the adsorption of these ions, and it is inferred that the membrane potentials are largely determined by the adsorption. With parchment membranes the differences are less marked and the adsorption effects are smaller, but increase in valency reduces the apparent mobility of an ion, the more strongly and at a concn. that is the higher, the higher is the valency. F. L. U.

Derivation of laws of ideal dilute solutions. H. Gehlen (*Z. Elektrochem.*, 1942, **48**, 110—112).—Mathematical. Equations for the b.p. elevation, f.p. and v.p. lowering, and osmotic pressure of dil. solutions have been derived from a consideration of chemical potential. C. R. H.

Derivation and biological implications of the general membrane equilibrium equation.—See A., 1942, III, 416.

Germicidal aërosols.—See A., 1942, III, 417.

Paraffin oil emulsions.—See B., 1942, III, 155.

Absorption of light by gold sols containing acacia gum and sodium chloride. R. V. Lloyd and D. P. Evans (*Trans. Faraday Soc.*, 1942, **38**, 179—186).—A method is described for preparing a standard red Au sol suitable for measurements of light absorption. Such a standard sol can be used to determine with accuracy the efficiency of different protective agents, by measuring the % absorption of red light (for which the observed changes are greatest) by sols 0·083N. in NaCl and containing varying amounts of protective. At a certain crit. concn. of protective the sols break and Au is pptd., and at this same point the curves connecting % light absorption with protective concn. exhibit a break the position of which can be determined with an exactness that increases with the duration of the experiment. This method provides a means of drawing finer distinctions between closely similar protectives than is possible by Zsigmondy's " Au no." method. F. L. U.

Gold sol. II. Chain formation in alternating electric field. H. R. Kruyt and J. G. Vogel (*Kolloid-Z.*, 1941, **95**, 2—20).—The formation in a Au sol of chains of particles by the action of an alternating field (cf. Pauli and Russer, A., 1932, 225; 1935, 1073) has been confirmed by the ultramicroscope. Accompanying changes in the electrical conductivity (κ) of the sol are satisfactorily accounted for by the occurrence of metallic conduction along the chains. Such changes, which may amount to a 25-fold increase in κ, can be prevented by decreasing the voltage, increasing the separation of the electrodes, or stirring. Chain formation is best seen in sols of the noble metals, and as a rule does not occur in hydrophobic sols of non-metallic substances. It is favoured by high dispersity, high particle concn., low concn. of intermicellar electrolyte, high potential gradient, and high frequency. The chains tend to set along the lines of force, and are usually branched; they break up spon-

taneously in the absence of an electric field. The phenomenon is attributed to incipient coagulation starting in the immediate neighbourhood of the electrodes. F. L. U.

Effect of autoclave treatment on the condition of hydroxides of beryllium, magnesium, and aluminium. T. Katsurai and T. Kita (*Kolloid-Z.*, 1941, **95**, 41—43).—Aq. suspensions of $Be(OH)_2$ and $Mg(OH)_2$ free from alkali but containing some Cl′ do not form sols when heated in an autoclave for 2 hr. at 190°, and the structure of the particles remains amorphous. Under similar conditions 0·1N-$BeCl_2$ is hydrolysed and forms a stable sol. An aq. suspension of $Al(OH)_3$ heated for 1 hr. at 190° gives a very stable sol, the properties of which are described. F. L. U.

Hydrous cupric hydroxide and basic cupric sulphates. H. B. Weiser, W. O. Milligan, and E. L. Cook (*J. Amer. Chem. Soc.*, 1942, **64**, 503—508).—The data from *X*-ray diffraction and from isothermal and isobaric dehydration indicate that $Cu(OH)_2$ is the only compound formed by the system CuO–H_2O. Spontaneous decomp. of blue $Cu(OH)_2$ gel to brownish-black CuO is accelerated by dil. alkali and is much more rapid than the decomp. of large crystals of $Cu(OH)_2$. If the ratio of equivs. of $CuSO_4$ (0·1—1·0N.) to alkali (0·1—1·0N.) in a mixture is $\leqslant$1 blue $Cu(OH)_2$ is formed; if $\geqslant$1·3, $4CuO,SO_3,3H_2O$ (**I**) is formed; if 1·25, $5CuO,SO_3,xH_2O$ (**II**) is obtained; if from 1 to 1·25, $Cu(OH)_2$ or CuO and (**II**) are co-pptd.; and if 1·25—1·33, mixtures of (**I**) and (**II**) are given. The identity of (**II**) has been established by *X*-ray diffraction data, by electrometric titration, and by analysis. In presence of low concns. of heavy metal sulphates $Cu(OH)_2$ is converted to (**II**) and is not stabilised. W. R. A.

Equilibria and changes in metal hydroxide sols. H. Bassett and R. G. Durrant (*J.C.S.*, 1942, 277—303).—Hydroxide sols of Al, Cr, Fe^{III}, La, Nd, and Th have been investigated to determine the nature of the stabilising ions, the way they are attached to the micelles, and the cause of the ageing of sols. In all cases Cl′ was the contra-ion. $NaPO_3$ and $(NH_4)_2SO_4$ were the principal coagulants, and conditions under which they are suitable for determining H′ and metal ion (M′) concn. in sols. have been developed and are discussed. The majority of the MOH sols appear to be emulsions, the second liquid phase having [MOH] so high that it constitutes a viscous " glass " with or without a cryst. core. The micellar charge is due to peptising cations adsorbed at the " glass " surface, in equilibrium with similar ions which are free in the intermicellar liquid. Some cations, accompanied by an equiv. no. of anions, will pass into solution in the " glass." If these are M′ there will be a tendency for co-ordinated H_2O to be replaced by co-ordinated MOH, resulting in the formation of very basic cations. If sufficient peptising cation is available the MOH may be converted into a basic salt which may continue as a sol, pass into true solution, or crystallise. An example of this last has been furnished by the separation of cryst. $3Th(OH)_4,ThCl_4,10H_2O$ (probably $[Th\{Th(OH)_4\}_3]Cl_4,10H_2O$) from $Th(OH)_4$ sol after 6 years, and there are indications that basic chlorides of La and Nd will crystallise from sols. Ageing of sols is attributed to one of four causes: (i) micelle coalescence with liberation of adsorbed cations, (ii) dehydration of the MOH constituent of the micelles, (iii) MOH crystallisation, and (iv) crystallisation of the " glass " as a basic salt or its passage into true solution. A no. of cryst. basic Al sulphates have been prepared and formulæ ascribed to four of them, viz., $[Al\{Al(OH)_3\}_4]_2[SO_4]_3[H_2O]_{17\text{ or }18}$, $[Al(OH)\{Al(OH)_3\}_3][Al\{Al(OH)_3\}_4]_4[SO_4]_7[H_2O]_{32\text{ or }33}$, $[Al(H_2O)\{Al(OH)_3\}_5][Al[Al(OH)_3\}_4][SO_4]_3[H_2O]_{20\cdot5\text{ or }21}$, and $[Al(H_2O)\{Al(OH)_3\}_5]_2[SO_4]_3$. C. R. H.

Dialysis in the study of colloids. VIII. Colloidal eerie hydroxide. V. C. Vora, P. M. Barve, and B. N. Desai (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 40—47).—The effects of dialysis, dilution, ageing, and exposure to sunlight on the cataphoretic speed, stability, conductivity, and viscosity of $Ce(OH)_4$ sol are recorded. F. J. G.

Viscosity and mol. wt. of chain polymerides. K. H. Meyer (*Kolloid-Z.*, 1941, **95**, 70—74).—Viscosity data for different classes of macromol. substances are reviewed, and it is shown that for unbranched chain polymerides the quotient η_{sp}/cM is not const. but decreases with increasing mol. wt. (M). Staudinger's " viscosity rule " cannot therefore give information about the form of dissolved mols., but is useful for obtaining the mol. wt. of a member of a series of chain polymerides by interpolation. F. L. U.

Relation between viscosity and temperature for cresol solutions of aniline-formaldehyde resins. W. Scheele, L. Steinke, and I. Avisiers (*Kolloid-Z.*, 1941, **95**, 74—81).—Data are recorded for the variation of η with temp. over the range 40—90° for cresol solutions of various NH_2Ph–CH_2O resins at different concns. The results can be represented with considerable accuracy by $1/\eta = Ae^{-\epsilon/kT}$, and the consts. A and ϵ are, for a given material, linear functions of the concn. The straight lines obtained by plotting $\log 1/\eta$ against $1/T$ for different concns. intersect at a common point corresponding with vals. of η and T the significance of which is discussed. F. L. U.

Viscosities of solutions of polyvinyl chloride. D. J. Mead [with R. M. Fuoss] (*J. Amer. Chem. Soc.*, 1942, **64**, 277—282).—Vals. of η for several polyvinyl chloride (**I**) samples, fractionated and polydisperse, have been obtained as a function of concn., temp., rate o shear, and solvent. The equiv. $\eta \propto$ concn., does not vary much with solvent [$PhNO_2$, mesityl oxide, *cyclo*hexanone (**II**), and $COMe{\cdot}C_5H_{11}$], and decreases slightly with rising temp. Increase in pressure causes a decrease in the val. of abs. η of solutions of (**I**) and this effect must be eliminated by extrapolation to zero pressure or by an empirical correction formula. An empirical formula has been derived which permits determination of the limiting equiv. η for zero concn. from a single η measurement at a finite concn. of (**I**). A fractionated sample, having equiv. η of 7·2 in (**II**) at 25°, has mol. wt. 102,000. W. R. A.

Cupri-ethylenediamine disperse viscosity of cellulose.—See B., 1942, II, 224.

Electrical properties of solids. XII. Plasticised polyvinyl chloride. D. J. Mead, R. L. Tichenor, and R. M. Fuoss (*J. Amer. Chem. Soc.*, 1942, **64**, 283—291).—Data at 40° and 60° at 60, 600, and 6000 cycles per sec. are given for polyvinyl chloride (**I**) plasticised with 8—30 wt.-% of 14 different plasticisers. Plasticisation causes separation of chain mols. by plasticiser mols. and is accompanied by a rapid decrease in micro- and macro-scopic coeffs. of friction. Concn. of plasticiser and loss factor have been connected empirically; η is inversely $\propto$ (relative concn.)[3 or 4]. The concn. of plasticiser required to produce a given internal η depends on the size and shape of the plasticiser mol.; long cylindrical mols. reduce $\eta >$ spherical mols. of the same mol. wt. Plasticisers of approx. the same size and shape are equally effective, irrespective of chemical structure, but with (**I**) plasticisers must contain a polar or polarisable group to ensure interaction with the polymeride. W. R. A.

Swelling and dissolution mechanism of xanthated sodium-cellulose fibres. IV. W. Schramek, U. Metzner, and E. Seidel (*Z. physikal. Chem.*, 1941, **B**, **50**, 298—304).—Whan xanthated Na-cellulose is dispersed in dil. NaOH the *X*-ray interference rings disappear although there is negligible conversion into the amorphous state. The results are compared with those obtained in similar experiments with regenerated cellulose and with natural fibres. C. R. H.

Calculation of protein–anion affinity constants from acid titration data. J. Steinhardt (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 191—199; cf. B., 1941, II, 338).—A method based on the following postulated equilibria is described: $WHA \rightleftharpoons WA^- + H^+$; $WA^- \rightleftharpoons W^{\pm} + A^-$; $WH^+ \rightleftharpoons W^{\pm} + H^+$; $WHA \rightleftharpoons WH^+ + A^-$, where $W^{\pm}$, WH^+, etc. represent ionic states of wool in combination with a strong acid HA. C. S. W.

Affinities of anions of strong acids for wool protein. J. Steinhardt, C. H. Fugitt, and M. Harris (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 201—216; cf. B., 1941, II, 338).—Titration curves of 18 strong acids (H_3PO_4, HPO_3, $H_4P_2O_7$, H_2SO_4, $NH_2{\cdot}SO_3H$, *o*-$OH{\cdot}C_6H_4{\cdot}SO_3H$, $C_8H_{17}{\cdot}O{\cdot}SO_3H$, $Bu^{\beta}SO_3H$, $C_{12}H_{25}{\cdot}SO_3H$, $C_{12}H_{25}{\cdot}O{\cdot}SO_3H$, $2\text{-}C_{10}H_7{\cdot}SO_3H$, $C_6H_4Ph{\cdot}SO_3H$, *p*-$OH{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_4{\cdot}SO_3H$-*p*′, $OH{\cdot}C_6H_3(CO_2H){\cdot}SO_3H$, anthraquinone-2-sulphonic acid, $C_{10}H_6Pr^{\beta}{\cdot}SO_3H$, *p*-$Ph{\cdot}[C_6H_4]_2{\cdot}SO_3H$, and the free colour acid of Orange II) are determined at 0°, 25°, or 50° by the methods previously described (B., 1940, 660; 1941, II, 77). From the data so obtained (after applying suitable corrections for effects of hydrolytic decomp.) and previously published results (B., 1941, II, 338), the affinities of the acid anions are calc. by the method of Steinhardt (see preceding abstract) and a pronounced tendency for the affinities of anions for wool to rise with increasing mol. wt. is revealed. The average heats of dissociation of several anion–wool complexes are tabulated. C. S. W.

Influence of shaking on the thixotropic sol–gel transformation. W. Heller and H. L. Roeder (*Trans. Faraday Soc.*, 1942, **38**, 191—194).—The difference between thixotropic and thixolabile systems is one of degree only, the latter being the more sensitive to mechanical coagulation. Shaking of thixotropic systems for periods varying from a few min. to a few hr. causes an increase in the setting time, examples of which are given for sols of V_2O_5 and of Fe_2O_3; the change is attributed to partial mechanical coagulation. The formation of strongly anisometric aggregates by shaking does not result in rheopexy but in an increase in setting time. F. L. U.

Kinetics of sol–gel transformation. V. Influence of different coagulating electrolytes on the setting of ferric phosphate gel. H. L. Dube and S. Prakash (*Proc. Indian Acad. Sci.*, 1941, **14**, **A**, 577—583; cf. A., 1940, I, 321).—The influence of coagulating ions on the setting of $FePO_4$ gels has been studied by consideration of the variation in vals. of p, the gel characteristic, and R, the rate const., in the equation $\log S = \log R + p \log C$. With uni-univalent (KCl, KBr, KNO_3) and multi-univalent ($MgCl_2$, $CaCl_2$, $BaCl_2$) electrolytes neither changes markedly, but with uni-multivalent electrolytes [K_2SO_4, $K_3Fe(CN)_6$, and K citrate] marked variations, consistent with Whetham's law, are observed. W. R. A.

Factors influencing flocculation and precipitation. Influence of initial particle size. E. M. Beavers, J. E. Magoffin, and F. K. Cameron (*Text. Res.*, 1941, **11**, 139—153).—The rate of settling of 1% bentonite sols, approx. uniform in particle size, after flocculation with H_2SO_4 has been determined. The data fit the equation $\log(1 - \alpha) = A \log t + D$, where α is the fraction settling in time t,

and A and D are consts., which is developed from the assumption that the flocs intermesh and are compressed by their own wt., thus affording progressively increased resistance to settling. The initial particle size affects the form of the flocs and hence their rate of settling, the change in the charge, and the absorption of acid; the acid causes floc formation, which promotes settling, but at higher concns. may affect their shape so as to retard settling, and a max. efficiency of pptn. is observed between 0·0117 and 0·0230N. W. A. R.

Rhythmic precipitation of silver chloride in gelatin tanned with chromium chloride. C. S. Narwaini and G. T. Gursahani (*J. Indian Chem. Soc.*, 1941, **18**, 531—534).—Liesegang rings of AgCl are obtained when $AgNO_3$ diffuses into gelatin that has been tanned with $CrCl_3$ of such concn. that all the available Cl is combined with the gelatin. The effect of varying the concn. of gelatin, $CrCl_3$, and $AgNO_3$ on the character of the rings is described. F. L. U.

Silica and the Liesegang phenomenon. A. C. Copisarow and M. Copisarow (*Nature*, 1942, **149**, 413).—Aq. commercial waterglass (1 : 1 by vol.) covered with conc. HCl at 17° immediately gives a fine network structure which soon becomes a translucent membrane at the interface. White horizontal bands then gradually extend below the membrane and tend to arrange themselves in groups. With more dil. Na_2SiO_3 the reaction was quicker and the bands were more closely packed. Anomalies attended the substitution of SO_2 or H_2SO_4 for HCl. The interfacial membrane was never distorted by protuberances etc. A. A. E.

Electrophoresis of mixtures of ovalbumin and yeast-nucleic acid.—See A., 1942, III, 487.

VI.—KINETIC THEORY. THERMODYNAMICS.

Improved values for the equilibrium constants and degrees of dissociation for certain important gas equilibria. H. Zeise (*Z. Elektrochem.*, 1942, **48**, 23—26).—New vals. for the energy change, equilibrium const., and degree of dissociation for the reactions $H_2O \rightarrow 0{\cdot}5H_2 + OH$ and $OH \rightarrow O + H$ have been calc. on the basis of Dwyer's val. for the energy change in $H_2O \rightarrow H + OH$ (cf. *Physicol Rev.*, 1941, [ii], **59**, 928). C. R. H.

Gas equilibrium $C_2H_6 \rightleftharpoons C_2H_4 + H_2$. H. Zeise (*Z. Elektrochem.*, 1942, **48**, 30—32).—The author claims to have anticipated Guggenheim (cf. A., 1941, I, 113) in his method of calculating the equilibrium const. for the decomp. of C_2H_6 (cf. A., 1940, I, 321). New vals. calc. on the basis of more accurate data agree more closely with Guggenheim's vals. than did the earlier vals. C. R. H.

Lead citrate complex ion.—See A., 1942, III, 412.

Spectroscopic investigation of the association of ferric ions with chloride, bromide, and hydroxyl ions. E. Rabinowitch and W. H. Stockmayer (*J. Amer. Chem. Soc.*, 1942, **64**, 335—347).—Absorption curves for $Fe(ClO_4)_3$ solutions in the presence of different amounts of OH′, Cl′, and Br′ ions have been determined at different temp. and ionic strengths (μ). Curves for the $Fe(ClO_4)_3$–$HClO_4$ system have been analysed and the absorption curve of free (hydrated) $Fe^{\cdot\cdot\cdot}$ ions separated from that of $Fe(OH)^{\cdot\cdot}$ ions. Similarly absorption curves for solutions containing HCl or HBr have been analysed and show successive association steps. Curves for $FeCl^{\cdot\cdot}$, $FeCl_2^{\cdot}$, $FeCl_3$, and $FeBr^{\cdot\cdot}$ (all yellow) have been derived. $FeCl_4'$ ions exist only in very conc. solutions. Equilibrium consts. for the formation of $FeCl^{\cdot\cdot}$, $FeCl_2^{\cdot}$, $FeCl_3$, and $FeBr^{\cdot\cdot}$ at $\mu = 1$ have been derived and the distribution of Fe^{III} between several ionic species at different chloride concns. has been calc. The heats and entropies of formation of $(FeOH)^{\cdot\cdot}$, $(FeCl)^{\cdot\cdot}$, and $(FeBr)^{\cdot\cdot}$ ions have been evaluated. W. R. A.

Many-acid problem. K. J. Mysels (*J. Chem. Educ.*, 1941, **18**, 478—479).—A method for calculating the degree of neutralisation of a mixture of aq. acids when p_H is known is given. L. S. T.

Glass electrode measurements of the p_H of chromic acid solutions. W. H. Hartford (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 174—176).—Except for a small variation with temp. in dil. solutions, the effect of temp., purity of acid, and H_2O on the p_H of aq. CrO_3 is negligible. Variations in the measurements occur with different types of instrument at p_H vals. <2; much of this discrepancy is due to liquid junction potentials. Each instrument gives consistent readings, and can be used for control purposes. L. S. T.

Thermodynamics of aqueous solutions of potassium chloride at temperatures from 15° to 45° from e.m.f. measurements on cells with transference. W. J. Hornibrook, G. J. Janz, and A. R. Gordon (*J. Amer. Chem. Soc.*, 1942, **64**, 513—516).—Activity and osmotic coeffs., obtained from e.m.f. measurements on the cell Ag,AgCl|KCl(m_1)|KCl(m_2)|AgCl,Ag at concns. up to 0·1M. and 10° intervals from 15° to 45°, agree well with recorded vals. W. R. A.

Activity coefficients of rubidium and cæsium sulphates in aqueous solution at 25°. H. H. Cudd and W. A. Felsing (*J. Amer. Chem. Soc.*, 1942, **64**, 550—551).—Isopiestic ratios for Na_2SO_4–Rb_2SO_4 and Na_2SO_4–Cs_2SO_4 have been determined for aq. solutions (~0·4—1·8M.). The activity coeffs. of Rb_2SO_4 and Cs_2SO_4 have been calc. from the observed molalities and ratios by comparison with those of Na_2SO_4. W. R. A.

Activity coefficients of strontium chloride by an isopiestic method. B. A. Phillips and G. M. Watson [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1942, **64**, 244—247).—Activity coeffs. of aq. $SrCl_2$ (0·05—1·30M.) have been determined by an improved isopiestic method using $BaCl_2$ as the reference standard. W. R. A.

Phase-rule experiments with organic compounds. C. M. Mason, B. W. Rosen, and R. M. Swift (*J. Chem. Educ.*, 1941, **18**, 473—474). L. S. T.

Binary halide systems. I. System sodium chloride–magnesium chloride. W. Klemm and P. Weiss (*Z. anorg. Chem.*, 1940, **245**, 279—284).—Thermal and X-ray analysis shows the existence of the compounds $NaCl,MgCl_2$ and $2NaCl,MgCl_2$, each with incongruent m.p. The tendency to form compounds with the corresponding Mg halide increases from Li to K halides and from bromides to fluorides. J. W. S.

System ferric chloride–sodium chloride. H. F. Johnstone, H. C. Weingartner, and W. E. Winsche (*J. Amer. Chem. Soc.*, 1942, **64**, 241—244).—$FeCl_3$ and NaCl do not form a compound but form a eutectic (44 mol.-% NaCl, m.p. 158°). The v.p. of $FeCl_3$ and of 3 mixtures with NaCl have been determined by a static method. The low v.p. of $FeCl_3$ in the presence of NaCl at temp. > the b.p. of pure $FeCl_3$ is due to NaCl (solute) lowering the v.p. Thus, the possibility of volatilising $FeCl_3$ during chlorination of ores in the presence of excess of NaCl is prevented. W. R. A.

Vapour–liquid equilibria of the system acetone–acetic acid–water. R. York, jun., and R. C. Holmes (*Ind. Eng. Chem.*, 1942, **34**, 345—350).—The vapour–liquid equilibria at 760 mm. of the binary systems $COMe_2$–H_2O, $COMe_2$–AcOH, and AcOH–H_2O and of the ternary system $COMe_2$–AcOH–H_2O have been investigated, using a still of the pattern described by Scatchard *et al.* (A., 1938, I, 400) and utilising d and acidity measurements for analysis of the samples. The ternary system shows considerable deviations from Raoult's law. J. W. S.

Determination of dineric distribution. W. D. Bancroft and S. S. Hubard (*J. Amer. Chem. Soc.*, 1942, **64**, 347—353).—In a system of three liquid components containing two immiscible components each consolute with the third, the composition of the conjugate phases may be conveniently determined, knowing the isothermal diagram for the system at the desired temp., by a graphical method which is described. The method has been applied to the systems C_6H_6–EtOH–H_2O and $CHCl_3$–$COMe_2$–H_2O, in which the distribution over the entire range of concn. can be expressed by equations of the mass law type which do not ignore increase in the mutual solubility of the slightly miscible liquids on addition of the consolute liquid. W. R. A.

Active substances. LI. Equilibria between CO_2–CO and Ni–NiO and between CO_2–CO and (Ni + γ-Al_2O_3)–$NiAl_2O_4$, and their influence on the physical state of the solid reactants. LII. Boudouard decomposition in the systems Ni–NiO and (Ni + γ-Al_2O_3)–$NiAl_2O_4$. R. Fricke and G. Weitbrecht (*Z. Elektrochem.*, 1942, **48**, 87—106, 106—110).—LI. The equilibria have been investigated over a range of temp., and the solid phases have been subjected to X-ray examination. Calculations of the surface energy of the solid phases have been made and applied to a discussion of the data which is concerned chiefly with the influence of particle size of the reactants on surface energy and with heats of reaction, especially of Ni-spinel (**I**) formation.

LII. The dissolution in Ni of C derived from the decomp. of CO has been examined. Ni obtained by reduction of NiO loses its dissolved C more slowly than does Ni from (**I**). This is due to the smaller particle size and greater surface activity of Ni from (**I**), and the consequent ease of diffusion of C through the Ni surface. C. R. H.

Thermodynamic constants of the dithionite (hyposulphite) ion. W. G. McMillan, jun., J. D. Roberts, and C. D. Coryell (*J. Amer. Chem. Soc.*, 1942, **64**, 398—399).—The molal heat content in dil. solution of the $S_2O_4^{\cdot\cdot}$ ion is −178·7 kg.-cal. Re-examination of Jellinek's potentiometric data (A., 1911, ii, 365) gives −178·3 kg.-cal. for the heat content and −143·4 kg.-cal. for the free energy of the ion. W. R. A.

VII.—ELECTROCHEMISTRY.

Conductances of aqueous solutions of lithium, sodium, and potassium hydroxides at 25°. L. S. Darken and H. F. Meier (*J. Amer. Chem. Soc.*, 1942, **64**, 621—623).—Vals. of Λ_0 have been deduced from the conductances of aq. LiOH, NaOH, and KOH at 25°. At low concn. NaOH and KOH behave as typical strong electrolytes, whereas LiOH shows measurable deviation from complete ionisation. W. R. A.

Anomalies in conductivity measurements in presence of hydrogen peroxide. M. Bobtelsky and A. E. Simchen (*J. Amer. Chem. Soc.*, 1942, **64**, 454—461).—In conductometric titrations in presence of H_2O_2 additional resistances (ΔR) are encountered which reach a max. at small [H_2O_2] (~0·02M.) and diminish on further addition of H_2O_2.

The variation of $\Delta R_{max.}$ with changes in electrolyte concn., nature of electrolyte, nature of electrodes, temp., stirring velocity, and a.c. frequency has been investigated. The effect depends mainly on $[H_2O_2]$, and on the chemical nature of the electrode (*e.g.*, Sn > Pt) but not on its physical condition (bright Pt = grey platinised Pt). W. R. A.

Determination of the transference numbers of potassium iodide from the electromotive force of iodide-iodine gravity cells. S. W. Grinnell and F. O. Koenig (*J. Amer. Chem. Soc.*, 1942, **64**, 682—686).—Precise measurements with a special potentiometer (described) of the e.m.f. of gravity cells using the earth's field with the electrode Pt, KI (excess) + I give vals. for the transference no. of K' in agreement with the best modern vals. W. R. A.

Standard potential of silver-silver bromide electrode in anhydrous methanol at 25°. E. W. Kanning and A. W. Campbell (*J. Amer. Chem. Soc.*, 1942, **64**, 517—519).—The potential of the cell (Pt)H_2|HBr, MeOH|AgBr, Ag has been measured at 25° over the concn. range 0·000474—0·0543M. On the molality basis the standard potential of the AgBr electrode in MeOH solution of HBr is −0·1328 v., and −0·1451 v. on the molarity basis. The val. of 1·42 for the const., *A*, as compared to the theoretical val. of 2·11, shows deviations from the Debye–Hückel limiting law for the solutions studied. W. R. A.

Physico-chemical studies with aqueous fluoride solutions. I. Decomposition and discharge potentials of fluorides in aqueous solution. H. Shrivastava (*Proc. Indian Acad. Sci.*, 1941, **14, A**, 535—546).—The decomp. potentials of aq. HF, LiF, NaF, KF, NH_4F, KHF_2, AgF, CdF_2, and SbF_3 and the cathode and anode discharge potentials of aq. NH_4F, KHF_2, AgF, CdF_2, and SbF_3 have been measured at 25° with polished Pt electrodes. Current–voltage curves of LiF, NaF, NH_4F, KF, and KHF_2 have two breaks, one const. at 1·55±0·5 v. and the other at a higher potential which varies with the metallic ion and with concn. The SbF_3 curve has two breaks, each dependent on concn., but the curves for HF, AgF, and CdF_2 have only one break. Only the current–cathode potential curves for NH_4F, KHF_2, and SbF_3 have two breaks corresponding with the breaks in the current–voltage curves, all other current–cathode (anode) potential curves having only one break. It is concluded that alkali fluorides may have a true decomp. potential in aq. solution. W. R. A.

Electrical activity of acetylcholine. R. Beutner and T. C. Barnes (*Science*, 1941, **94**, 211—212).—Production of negative electrical potential by contact between very dil. solutions of acetylcholine and H_2O-sol., lipin-like substances is demonstrated. E. R. R.

Preferential ionic permeability of membranes of cupric ferrocyanide and of parchment. [**Membrane potentials.**]—See A., 1942, I, 236.

Overvoltage. XI. Some unusual overvoltage phenomena. XII. Long time charge and decay phenomena. A. L. Ferguson and H. Bandes (*Trans. Electrochem. Soc.*, 1942, **81**, *Preprints* 10 and 11, 105—122, 123—134).—XI. A resumé of the problems in electrolytic systems and a crit. survey of theories of overvoltage is given. An apparatus for obtaining a photographic record of the variations of the potential of a polarised electrode with time, or rates of polarisation, is described. This has been used to study the decay of polarisation and to measure the *IR* potential drop of both anodes and cathodes in 2N-H_2SO_4, and the effects of previous charge, c.d., time of charge, and rate of agitation have been investigated; charge and decay curves are given.

XII. Long-time charge and decay curves for anode, cathode, and total cell potentials when cells are polarised to different c.d. are given; the fundamental nature of the process appears distinctly different for anode and cathode. The importance of the discharge of ions at the electrodes even at the lowest applied potentials is emphasised, and breaks in both charge and discharge curves at ~1·23 v. and 1·58 v., the theoretical potential of the O_2–H_2 cell and the observed decomp. potential of H_2O respectively, have been found. J. L. E.

Structure of the anodic passive layer on zinc. K. Huber (*Z. Elektrochem.*, 1942, **48**, 26—29).—The passivity of Zn and in particular the colour changes which a Zn anode undergoes in NaOH solutions of various concns. are discussed. As [NaOH] increases the darkening of the anode is less pronounced when viewed by reflected light, although in diffused light the differences in colour are not so noticeable. At low [NaOH] amorphous $Zn(OH)_2$ appears on the anode. The passive layer can be removed as thin scales after momentarily reversing the current so as to make the anode active again. The scales, which have a highly disperse structure, are doubly refractive. The structure of the layer as revealed by *X*-ray analysis is discussed. C. R. H.

Electrode polarisation in dielectric constant measurements. W. G. Smiley and A. K. Smith (*J. Amer. Chem. Soc.*, 1942, **64**, 624—628).—The polarisation capacitance (r) of Pt electrodes in very dil. H_2SO_4, H_2CO_3, and NaCl, alone and with glycine, gelatin, and $COMe_2$, has been measured by an apparatus which is described. An empirical equation connecting variation of r and frequency is advanced. r increases with decreasing p_H. W. R. A.

Chemical polarisation in the precipitation of metals from and their dissolution in electrolytes. G. Masing (*Z. Elektrochem.*, 1942, **48**, 85—86).—Polarisation curves based on the equations of Le Blanc and Schick are shown to be of limited applicability. C. R. H.

Polarographic study of phthalic acid and phthalates. N. H. Furman and C. E. Bricker (*J. Amer. Chem. Soc.*, 1942, **64**, 660—668).—*o*-$C_6H_4(CO_2H)_2$ (**I**) and its salts have been investigated polarographically over the p_H range 1—8. The distribution of total phthalate between undissociated mols. and H phthalate and phthalate ions has been calc. Three reproducible polarographic waves due to phthalate are found in unbuffered solutions near p_H 4 with multivalent cations present. The no. and height of the waves depend on p_H of the buffer, but in buffered solutions the height can be used for quant. measurements. Small successive additions of $BaCl_2$, $Ba(OAc)_2$, $CaCl_2$, and $LaCl_3$ to well-buffered phthalate solutions at p_H 3·6 diminish the first wave systematically but not linearly. The amount of undissociated (**I**), derived from polarographic data, agrees with the theoretical distribution of the undissociated form as a function of p_H. Approx. half-wave potentials for phthalate waves are given at various p_H vals. The slopes of typical curves have been analysed. W. R. A.

Polarographic examination of water for surface-active substances. K. E. Schwarz, H. J. Schröder, and M. von Stackelberg (*Z. Elektrochem.*, 1942, **48**, 6—9).—The dependence of the height of the max. of polarographic curves on the relative concns. of electrolyte and reducible substance is discussed and illustrated with data for KCl–O_2 solutions. Surface-active substances have a damping effect on the max. of such curves. A self-recording apparatus, involving a dropping Hg electrode, which makes use of this property and is suitable for determining impurities in H_2O, is described. C. R. H.

VIII.—REACTIONS.

Rate equations for consecutive reactions. T. L. Hill (*J. Amer. Chem. Soc.*, 1942, **64**, 465—467).—Mathematical. Procedures for solving the system of the first-order differential equations corresponding with a set of consecutive or chain reactions are discussed. W. R. A.

Thermal reaction between hydrogen and oxygen at higher pressures. O. Oldenberg and H. S. Sommers, jun. (*J. Chem. Physics*, 1942, **10**, 193; cf. A., 1941, I, 302).—A reply to Dainton (A., 1942, I, 101). L. J. J.

Limits of inflammability of acrylonitrile in air. G. W. Jones, R. E. Kennedy, and G. S. Scott (*U.S. Bur. Mines*, 1941, *Rept. Invest.* 3597, 1—6).—CH_2:CH·CN (**I**) yields inflammable mixtures when air at 745—750 mm. pressure is saturated with its vapour between −6·25° and 29·4°. This temp. range corresponds with mixtures containing 3·05—17·0 vol.-% of (**I**). J. W. S.

Macromolecular compounds. CCLXXV. Kinetics of chain polymerisations. XI. Polymerisation of methyl methacrylate. G. V. Schulz and F. Blaschke (*Z. physikal. Chem.*, 1941, **B, 50**, 305—322).—The rate of polymerisation of CH_2:$CMe·CO_2Me$ is not influenced by the size of the reaction vessel or by the condition of the vessel walls. At 100° and in presence of air or O_2 the reaction is in two stages, a preliminary slow stage until 20—30% polymerisation has occurred followed by a very rapid stage. At 140° the progress of the reaction is more regular. At 100° there is an induction period which is absent at 140°. The induction period disappears at ~125°. It also disappears in presence of peroxides, suggesting that peroxide formation takes place during the induction period. The reaction is much slower in N_2 than in air or O_2. A chain mechanism for the reaction is proposed. C. R. H.

Nuclear substitution of benzene derivatives.—See A., 1942, II, 220.

Kinetic study of acidolysis phenomena. A. Chablay (*Compt. rend.*, 1941, **213**, 242—244).—Investigations previously reported (cf. A., 1938, I, 522) are extended to the reversible reaction between RCO_2H and heptoic and octoic acid. The vals. found for the const. k of the mass action law are 1·05 and 1·01, respectively. N. M. B.

Kinetics of the mutarotation of aminomethylene-*d*-camphor. B. K. Singh and S. C. Sen (*Proc. Indian Acad. Sci.*, 1941, **14, A**, 572—576).—Aminomethylene-*d*-camphor is converted into iminomethylene-*d*-camphor in glacial AcOH, measurably at 35° and rapidly at higher temp.; the reaction is of the first order. Mutarotation in 75—90% AcOH differs from mutarotation in glacial AcOH in that the initial rise in [α] is followed by a gradual fall, the extent of which varies with [AcOH]. In aq. AcOH the mutarotation is no longer of the first order. W. R. A.

Mutarotation of glucose in water–methanol mixtures. H. E. Dyas and D. G. Hill (*J. Amer. Chem. Soc.*, 1942, **64**, 236—240).—The rate of mutarotation of glucose has been studied in H_2O–MeOH mixtures (0—75% MeOH) at 20° and 29·2°; it changes in the directions to be predicted from the dielectric const. of the mixtures although not quite theoretically. Vals. of [α] of α- and β-glucose and of their solutions in the H_2O–MeOH mixtures have been determined at 20° and 30°. Equilibrium consts. for the reaction are not

independent of temp. The heats of reaction and of activation change greatly and in parallel with [MeOH], with max. or min. in 60% MeOH. W. R. A.

Hydrolysis. Comparison of the saponification constants of the tolyl and methyl*cyclo*hexyl esters of fatty acids. B. E. Mirza and G. D. Advani (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 72—77).—Velocity coeffs. are recorded for the saponification by EtOH–KOH at 35° of tolyl and methyl*cyclo*hexyl esters of AcOH (**I**), $EtCO_2H$ (**II**), and $PrCO_2H$ (**III**). For a given acid, the coeff. for the methyl*cyclo*hexyl ester is always > that for the corresponding tolyl ester, the ratio being ~10 for *p*- and *m*-compounds, and 2—3 for *o*-compounds. For a given alcohol the ratios of the coeffs. for different acids are (**I**) : (**II**), 2·8, and (**II**) : (**III**), 1·6. F. J. G.

Kinetics of hydrolysis of carbamide and arginine. R. C. Warner (*J. Biol. Chem.*, 1942, **142**, 705—723).—Experiments at 35°, 60°, and 100° and at p_H <1—14·5 show that the products of hydrolysis of $CO(NH_2)_2$ are NH_3 and HCNO, the reaction being reversible at p_H vals. at which NH_3 is ionised. In acid solution, the rapid hydrolysis of HCNO limits the reversibility of the reaction. HCNO is hydrolysed to NH_3 and CO_2, the rate of hydrolysis in alkaline solution being independent of p_H. At p_H <9, the rate increases rapidly. The assumption that HCNO is the only intermediate in $CO(NH_2)_2$ hydrolysis quantitatively accounts for the course of the transformation at all p_H. Two simultaneous reactions of the first order with respect to arginine (**I**) concn., namely, production of NH_3 and citrulline and production of $CO(NH_2)_2$ and ornithine, occur during hydrolysis of (**I**). W. McC.

Kinetic study of the reactions of *n*-butyl bromide with the sodium salts of phenol, thiophenol, and *n*-butyl mercaptan. O. R. Quayle and E. E. Royals (*J. Amer. Chem. Soc.*, 1942, **64**, 226—230).—The order of reactivity with Bu^aBr is $NaSBu^a > NaSPh > NaOPh$ under comparable conditions in MeOH and in EtOH. Rate consts. decrease with increasing initial concn. of reactants. Neutral salts exert an effect similar in sign and magnitude to the initial concn. effect. The order of reactivity of $NaSBu^a$ with Bu^aBr in different solvents is EtOH > MeOH > C_6H_6. A mechanism involving an electron drift from the OR or SR group to the C atom is postulated. W. R. A.

Kinetics of the periodate oxidation of 1 : 2-glycols. II. Ethylene glycol, pinacol, and *cis*- and *trans*-*cyclo*hexene glycols. C. C. Price and M. Knell (*J. Amer. Chem. Soc.*, 1942, **64**, 552—554; cf. A., 1939, I, 32).—*k* are recorded for oxidation of *cis*- (**I**) and *trans*-*cyclo*hexene 1 : 2-glycol [slower than that of (**I**) or $(CH_2{\cdot}OH)_2$] by H_5IO_6 at initial p_H 1—11·5. At initial p_H 7·5—10 the p_H increases during the reaction. $\log k \propto p_H$, with none of the irregularities shown by pinacol (*loc. cit.*). The reaction mechanism (discussed) probably involves a cyclic diester of H_5IO_6 formed by a double inversion. R. S. C.

Rate of oxidation of copper at room temperature. A. H. White and L. H. Germer (*Trans. Electrochem. Soc.*, 1942, **81**, *Preprint* 9, 91—104).—Electron diffraction technique is described. In O_2 (20 mm.) at room temp. and for time t >2 min. the rate of reaction $\propto 1/(t + c)$, where the const. c is ~0 but must be finite. The complete oxidation law can be expressed by $m/m_0 = 3W/(1 + 3W) = a + b \log_{10}(t + c)$, where m_0 is the original mass of Cu per unit area of film, m the mass of Cu per unit area in the Cu_2O, W the ratio of the integrated intensities of the diffraction rings of Cu_2O and Cu, and t is measured in min. (>2), a, b, and c being consts.; from this it is estimated that the local thickness, x, of the oxide film increases according to $x = 4 + 6{\cdot}5 \log_{10} t$ A., which predicts a limiting film thickness of ~50 A. J. L. E.

Influence of electrolytes on ammonolysis by liquid ammonia. J. F. Lemons, P. M. Williamson, R. C. Anderson, and G. W. Watt (*J. Amer. Chem. Soc.*, 1942, **64**, 467—468).—The energy of activation for the ammonolysis of 1-chlorobenzthiazole is increased by addition of NH_4Cl, NH_4OBz, $NH_2{\cdot}SO_3NH_4$, $NH_2{\cdot}CO_2NH_4$, $(NH_4)_2CO_3$, NaCl, and KCl. Rates of reaction are not appreciably or regularly affected. W. R. A.

Halogen addition to ethylene derivatives. I. Bromine additions in presence of bromide ions. II. Mechanism of the halide ion-catalysed addition reaction. III. Bromine and iodine additions in glacial acetic acid. K. Nozaki and R. A. Ogg, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 697—704, 704—708, 709—716).—I. The equilibrium const. for the dissociation of KBr_3 in glacial AcOH has been determined at 30°, 50°, and 70°. The reaction between Br and maleic and fumaric acids has been studied in glacial AcOH. In presence of LiBr *trans* additive products are obtained. The reactions are sensitive to the concn. of proton donors and the ionic strength of the reaction solution, but not to light or O_2. H_2O retards. The reaction between Br and $CH_2{:}CHBr$ in glacial AcOH is not affected by the concn. of proton donors or the ionic strength of the solution. LiBr and HBr catalyse the reaction of Br with $CH_2{:}CH{\cdot}CH_2Cl$ (**I**) to the same extent but for the reaction between Br and $CH_2{:}CH{\cdot}CH_2{\cdot}OAc$ (**II**) HBr is superior to LiBr.

II. The reaction between Br and $CH_2{:}CHBr$ in presence of added LiCl in glacial AcOH solution conforms to $d[Et]/dt = k[Br][Cl'][Et]$. The (**I**)–Br and (**II**)–I reactions are catalysed by OAc', NO_3', and HSO_4' ions as well as by halide ions. The most probable mechanism for the halide-ion-catalysed addition of halogen to C_2H_4 derivatives is a termol. reaction between the C_2H_4 derivative, halide ion, and halogen mol.

III. The reaction (*a*) between Br and (**I**) in glacial AcOH is complex, yields a mixture of products, and is greatly affected by small amounts of H_2O but uninfluenced by O_2 or packed reaction vessels. The reactions between Br or I and (**II**) are similar to reaction (*a*) but the reaction between I and $CH_2{:}CH{\cdot}CH_2{\cdot}OH$ is still more complex. The mechanisms for the reactions are discussed in terms of a complex rate expression. W. R. A.

Kinetics of the hydrogen fluoride-catalysed reaction between toluene and *tert.*-butyl chloride. J. W. Sprauer and J. H. Simons (*J. Amer. Chem. Soc.*, 1942, **64**, 648—659).—The HF-catalysed reaction between PhMe and Bu^yCl is homogeneous and the rate is measurable at 25°. *p*-$C_6H_4MeBu^y$ is produced in quant. amounts. The reaction is of first order with respect to $[Bu^yCl]$ and $\propto p_{HF}^{5{\cdot}5}$. It is strongly promoted by H_2O and MeOH, retarded by HCl, but unaffected by O_2. Tentative mechanisms are advanced and one involving proton transfer or a mutual acid–base catalysis is favoured. W. R. A.

Catalytic action of nickel and copper–thorium in the formation of methane and heavy gases. A. van Itterbeek and W. van Dingenen (*Z. physikal. Chem.*, 1941, **B**, **50**, 341—360).—The adsorption of H_2–CO mixtures by Ni foil has been determined at low pressures (<2 mm. Hg) and over a wide temp. range. At 167° and 329° H_2 and CO are adsorbed in the ratio 3 : 1 corresponding with CH_4 formation, and at 125° and 378° they are adsorbed in the ratio 2 : 1 corresponding with higher paraffin formation. The reaction rates also show max. at these temp. Cu adsorbs H_2 and to a smaller extent CO only if it contains traces of Th. At 250° and 325° H_2 and CO are adsorbed in the ratio 3 : 1. Similar experiments with D_2 are described. C. R. H.

Catalytic oxidation of ammonia to nitrous oxide in presence of oxides. W. Krauss and A. Neuhaus (*Z. physikal. Chem.*, 1941, **B**, **50**, 323—340).—NH_3–air and NH_3–O_2 mixtures were passed over heated oxides of Mn, Bi, Ba, Fe, and Ni, and the yields of N_2O, NO, and N_2 were determined. On the basis of the results a reaction scheme is discussed in which NH_3 and O unite to form NH_3O which then reacts with O to form HNO, with HNO to form N_2, and with O_2 to form HNO_2 which either reacts with NH_3 to form N_2 or decomposes to NO. N_2O is formed by the union of two HNO. C. R. H.

Zinc–nickel couple in the hydrogenation of organic compounds.—See A., 1942, II, 213.

Hydrogenation with Raney catalysts.—See A., 1942, II, 213.

Protection of ferrous metals by galvanic methods.—See B., 1942, I, 270.

Physical factors in electrodeposition of nickel on iron.—See B., 1942, I, 272.

Photochemical activity of mixtures of vanadic acid and tartaric acid. I. Optical properties of the mixtures. Their reduction in light and in the dark. II. Photocatalysis by colloidal micelle obtained by reduction of vanadic acid and tartaric acid mixtures. Induced optical activity by circularly polarised light. T. L. R. Char (*J. Indian Chem. Soc.*, 1941, **18**, 507—522, 563—572).—I. A solution of $NaVO_3$ to which tartaric acid (**I**) has been added exhibits an optical rotation opposite in sign to that of the acid used. The rotation of the mixture is diminished by addition of HCl or of (**I**) to an extent depending only on the p_H. Addition of acid also causes the initial deep red colour to fade, finally to pale yellow, the extinction coeff. for blue light again depending only on the p_H. The dispersed substance in these mixtures is represented by $[xVO_3', y(I), zH^+]$ (**II**). At p_H <4 reduction of the VO_3' in this complex occurs in the dark with a velocity that increases with decreasing p_H. The velocity of the dark reaction is the same for *d*-, *l*-, and an equimol. mixture of *d*- and *l*-(**I**), but a considerably greater velocity is found with racemic acid. In visible or ultra-violet light reduction of V^V to V^{IV} occurs with the simultaneous formation of dihydroxytartaric acid. The photochemical reaction is small at low p_H but can be conveniently studied at p_H >4, when the dark reaction does not occur. Velocity data are recorded for red, green, and ultra-violet light, and a reaction mechanism is proposed.

II. If the colloid (**II**) is subjected to complete photochemical reduction to the V^{IV} state the solution obtained is optically inactive and shows no circular dichroism in the visible region when *i*-(**I**) is used for the reduction, but is both optically active and circularly dichroic when *d*- or *l*-(**I**) is used. The micelle (**III**) formed by reduction with *d*-(**I**) shows positive rotation and negative ellipticity, and the converse is true for reduction with *l*-(**I**). Photo-reduction of persulphate by (**I**) is catalysed by (**III**), the velocity being the same whatever variety of (**I**) is used in its prep. If, however, the S_2O_6'' reduction is carried out in *d*- or *l*-circularly polarised light, different velocities are observed according to whether *d*- or *l*-reduced

(III) is used as the catalyst. Finally, if the photo-reduction of S_2O_8'' takes place in the presence of *dl*-reduced (III), the use for this purpose of *d*- or *l*-circularly polarised light leads to the production of *l*- or *d*-activity, respectively. F. L. U.

Photolysis of methyl acetate. W. L. Roth and G. K. Rollefson (*J. Amer. Chem. Soc.*, 1942, **64**, 490—494).—The Hg-sensitised and the non-sensitised photolyses of MeOAc yield Ac_2, $COMe_2$, MeOH, CO, CO_2, CH_4, C_2H_6, and H_2. By considering the relative proportions of the products the principal primary process is shown to be a splitting into Ac and OMe radicals, from which other products are formed in secondary reactions. W. R. A.

Production of radicals by the illumination of diacetyl with 4358 A. H. W. Anderson and G. K. Rollefson (*J. Amer. Chem. Soc.*, 1942, **64**, 717).—On illumination with 4358 A. an equimol. mixture of Ac_2 and MeCHO reacts at a measurable rate at 100° and seven times as rapidly at 150°, yielding CO, CH_4, and a small amount of H_2 from decomp. of MeCHO. This indicates that Ac_2 is decomposed into radicals by 4358 A. and is in keeping with the previous result that photo-activated Ac_2 reacts with NO (A., 1941, I, 276). W. R. A.

Luminol light reactions. A. Steigmann (*Chem. and Ind.*, 1941, 889—890).—Cu salts are better and more lasting catalysts for producing light with luminol (I) and H_2O_2 than is hæmin, hæmoglobin, or blood; excess of (I) paralyses the catalyst and reduces the brightness of the glow and it is best to start the glow by adding the Cu as $(NH_2{\cdot}CH_2{\cdot}CO_2)_2Cu$ or by immersing a Cu wire in the solution of (I) rendered feebly alkaline by addition of $NaBO_3$ and NH_4Cl. Methods of stopping and restarting the glow are described and the use of the reaction in detecting blood, Fe and Co complexes, and Cu is indicated. A. R. P.

IX.—METHODS OF PREPARATION.

Separation of xenon isotopes by rectification. Triple point pressure of xenon. K. Clusius [with L. Staveley and G. Dickel] (*Z. physikal. Chem.*, 1941, **B**, **50**, 403—413).—The triple-point pressure of Xe is 612·2±0·2 mm. Hg at 161·36±·03° K. Attempts to separate Xe isotopes by rectification were unsuccessful, although a sample of mixed isotopes was obtained which had an at. wt. ~0·1 > that of normal Xe. C. R. H.

Mechanism of chemical reactions: thermal decomposition of nitrites. K. M. Mehta (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 135—136).—The decomp. of KNO_2 involves the reactions: (1) $2KNO_2 \rightleftharpoons K_2O + NO_2 + NO$; (2) $K_2O + 2NO_2 \rightarrow KNO_2 + KNO_3$; (3) $KNO_2 + NO_2 \rightleftharpoons KNO_3 + NO$; (4) $KNO_2 + NO \rightarrow KNO_2 + 0{\cdot}5N_2$; (5) $KNO_3 \rightarrow KNO_2 + 0{\cdot}5O_2$. With $AgNO_3$ the analogous reactions occur, with, in addition, $Ag_2O + NO \rightarrow 2Ag + NO_2$, and $Ag + 2NO_2 \rightarrow AgNO_3 + NO$. F. J. G.

Copper and nickel complex ions of diethylenetriamine. H. M. Haendler (*J. Amer. Chem. Soc.*, 1942, **64**, 686—688).—Vosburgh and Cooper's method of continuous variations (A., 1941, I, 220) is used to show formation of ions, $[Cu^{II}X]^{++}$, $[Cu^{II}X_2]^{++}$, $[Ni^{II}X]^{++}$, and $[Ni^{II}X_2]^{++}$ in H_2O, X being $NH([CH_2]_2{\cdot}NH_2)_2$, which acts as a tridentate group. R. S. C.

Isomorphous replacement of the elements in alkali alkaline-earth phosphates. R. Klement and F. Steckenreiter (*Z. anorg. Chem.*, 1940, **245**, 236—253).—*Na Sr*, *Na Ba*, *K Sr*, and *K Ba phosphates* have been prepared by sintering stoicheiometric proportions of $SrHPO_4$ or $BaHPO_4$ with Na_2CO_3 or K_2CO_3 at 900°. Like $NaCaPO_4$ they exist in high- and low-temp. forms. The P in the high-temp. form of $NaCaPO_4$ can be replaced by Si and S without change in the crystal structure but such replacement is possible only to a limited extent in $KCaPO_4$. Silicocarnotite, $Ca_5P_2SiO_{12}$, has a similar crystal structure to $NaCaPO_4$. J. W. S.

Reaction between roasted kaolin and lime in aqueous solution. I. Activity of roasted kaolin. W. Strätling and H. zur Strassen. **II. Reaction products in relation to the system lime–silica–alumina–water.** H. zur Strassen and W. Strätling (*Z. anorg. Chem.*, 1940, **245**, 257—266, 267—278).—I. The absorption of $Ca(OH)_2$ by kaolin, both unheated and after heating at 400—1100°, has been investigated by shaking with aq. $Ca(OH)_2$ at 20°. The kaolin is most active after heating at 500—700°, when max. absorption [~3 mols. of $Ca(OH)_2$ per mol. of $Al_2O_3,2SiO_2$] is attained after 40 days. The heats of wetting of the kaolin in H_2O and in aq. $Ca(OH)_2$ have been determined and it is shown that their difference, corresponding with the heat of adsorption of $Ca(OH)_2$, is a max. for the most active samples. This behaviour is particularly marked when the heat of wetting per unit surface are is considered.

II. *X*-Ray investigations of the products of the interaction of roasted kaolin with aq. $Ca(OH)_2$, made in comparison with the products of interaction of $3CaO,Al_2O_3$, $Ca(OH)_2$, and SiO_2 sol, indicate the presence of $3CaO,2SiO_2$,aq. and another solid probably $2CaO,Al_2O_3,SiO_2$,aq. (I). (I) is stable in contact with aq. $Ca(OH)_2$ but is decomposed at 250° or on hydrothermal treatment. Interaction of $3CaO,2SiO_2$,aq. and $3CaO,Al_2O_3$ or CaO,Al_2O_3,aq. in aq. media also yields (I). $3CaO,2SiO_2$,aq. and $3CaO,SiO_2$ are also formed during the hydration of cement clinker. J. W. S.

Basic phosphates of bivalent metals. V. Cadmium phosphate and hydroxyapatite. R. Klement and F. Zureda (*Z. anorg. Chem.*, 1940, **245**, 229—235; cf. A., 1939, I, 622).—Attempts to prepare $CdHPO_4$ have been unsuccessful. Slow addition of aq. Na_2PO_4 to cold aq. $CdCl_2$, with const. stirring, yields $Cd_3(PO_4)_2,5H_2O$. *X*-Ray examination indicates that the product obtained by heating CdF_2 with $Cd_3(PO_4)_2$ (from sintering $Cd_2P_2O_7$ and $CdCO_3$) is *Cd fluorapatite*, $Cd_{10}(PO_4)_6F_2$ (I). The *compounds* $Ca_9Cd(PO_4)_6F_2$, $Ca_5Cd_5(PO_4)_6F_2$, and $CaCd_9(PO_4)_6F_2$ have also been prepared. When the product of treating aq. $CdCl_2$ with hot aq. Na_3PO_4 is heated in H_2O for several days at 100°, or when (I) is heated at 100° with N-NaOH, impure $Cd_{10}(PO_4)_6(OH)_2$ (II) is obtained. (II) is isomorphous with the corresponding Ca and Sr compounds and has *a* 9·01, *c* 6·61 A. It is inferred that, as may be predicted from its ionic radius, Cd lies on the border between apatite- and wagnerite-forming metals. J. W. S.

Base exchange of mercuric ions adsorbed on wool. C. S. Narwani and G. T. Gursahani (*J. Indian Chem. Soc.*, 1941, **18**, 527—530).—Hg absorbed by wool from solutions of $HgCl_2$ in 0·025N-HCl is only partly chemically combined; the major part is adsorbed, and is exchangeable with cations in an external solution. The amount of $Hg^{"}$ exchanged with $Na^{'}$ increases with concn. up to a max. at ~0·2N-NaCl. Data for the exchange with various salt solutions are tabulated. F. L. U.

Stereochemistry. I. Steric strains as a factor in the relative stability of co-ordination compounds of boron. H. C. Brown, H. I. Schlesinger, and S. Z. Cardon (*J. Amer. Chem. Soc.*, 1942, **64**, 325—329).—NMe_3 forms more stable additive compounds than C_5H_5N with HCl, HBr, BH_3, and BF_3 but a less stable compound with BMe_3. Towards HCl 2:6-lutidine acts as a stronger base than C_5H_5N, whilst towards BF_3 C_5H_5N is the stronger. The reactions have been explained in terms of steric strains produced by steric hindrance of the groups about the co-ordinating central atom. The significance of the results on the concept of free rotation is discussed. W. R. A.

Normal aluminium chromate. P. C. Raychoudhury (*J. Indian Chem. Soc.*, 1941, **18**, 573—575).—By triturating $AlCl_3$ with excess of Ag_2CrO_4 and very little ice-cold H_2O a brown solution is obtained which on evaporation in a vac. at a low temp. gives a solid in which $Al_2O_3 : CrO_3 = 1 : 3$. Evaporation of a solution of the solid in AcOH to const. wt. in a refrigerator yields a *substance*, $Al_2(CrO_4)_3,5H_2O$. Data for the mol. conductivity and the p_H of solutions are recorded. F. L. U.

Polymerisation of derivatives of aluminium trimethyl.—See A., 1942, II, 240.

Periodates of tervalent metals. P. C. Raychoudhury (*J. Indian Chem. Soc.*, 1941, **18**, 576—578).—The following have been prepared: $3Bi_2O_3,2I_2O_7,7H_2O$, Al_2O_3,I_2O_7,H_2O, $FeH_2IO_6,4H_2O$, $2Tl_2O_3,I_2O_7,3H_2O$, $2PbO_2,I_2O_7,5H_2O$, $Mn_3(IO_5)_2$ (decomp. >15°). Their properties are described. F. L. U.

Structure of hydrogen cyanide. C. R. McCrosky, F. W. Bergstrom, and G. Waitkins (*J. Amer. Chem. Soc.*, 1942, **64**, 722—724).—HCNS in PhMe at 100—110° or 150—160° gives $C_2H_2N_2S_3$. No reaction occurs between HCN and S, Se, or Te at room temp., or S or S–PhMe at 100—120° or 150—160°. HCN and S in H_2O at 110—120° or 150—160° give by hydrolysis HCO_2NH_4 and NH_4CN, identified after further reaction as NH_4CNS. Thus ≯ traces of HNC exist at 25—160°. Passage of HCN into dry C_5H_5N + S (absence of air) gives exothermally *C_5H_5N thiocyanate*, m.p. 99·5—101°, and *selenocyanate*, m.p. 76—78° (decomp.), and *quinoline thiocyanate*, m.p. 138—139°, and *selenocyanate*, m.p. 99·5—100·5° (decomp.), are similarly prepared. Evaporation of aq. $NH_2Ph,HCNS$ gives $NH_2{\cdot}CS{\cdot}NHPh$, but $NH_2{\cdot}CSe{\cdot}NHPh$ is not obtained from NH_2Ph, HCN, and Se at 100°. $(CH_2{\cdot}NH_2)_2$ reacts with S or Se to give impure products. R. S. C.

Evaporation of aqueous solutions of sodium cyanide. E. von Papp and J. Pogany (*Angew. Chem.*, 1941, **54**, 55).—Addition of 0·5% of Zn dust or 0·5% of $NaHSO_3$ prevented decomp. of aq. 4-5N-NaCN on evaporation. Na_2CO_3 (≯20%) had no, and EtOH and glycerol a slight, effect. J. L. E.

Mechanism of the fission of hypophosphite; use of deuterium as indicator. W. Franke and J. Mönch (*Annalen*, 1941, **550**, 1—31).—The action between NaH_2PO_2 (I) and KOD in D_2O is not suitable for investigating the mechanism of the fission of (I). In heterogeneous catalysis (Cu, Pd, Co, Ni) in neutral solution there is very little exchange at room temp. Evolution of gas occurs mainly in such a manner that half the H arises from (I) and the other half from the H_2O or OH of (I), thus confirming Wieland's conception, $O{:}PH_2{\cdot}OH - 2H \rightarrow O{:}PH{:}O \rightarrow O{:}PH(OH)_2$ or $PH_2(OH)_3 \rightarrow O{:}PH(OH)_2$, but not Bach's formulation, $H_3PO_2 + 2OH|H = H_3PO_3 + H_2O + H_2$. In addition there is a second reaction in which both H atoms attached to P are removed. The last reaction appears to be favoured by increase in the concn. of H_3PO_2 and, probably, by the use of D_2O. Evolution of gas from a solvent

containing a mixture of H isotopes is accompanied by extensive isotope separation but this effect is not appreciable with a partly heavy (I). The metal-catalysed fission of formate follows the lines of the main course of decomp. of H_3PO_2. NaD_2PO_2 is most economically obtained from NaH_2PO_2 and D_2O in presence of 5·2N-D_2SO_4 at 38°. H. W.

Behaviour of chromic bromide towards ether. F. Hein and H. Kraft (*Z. anorg. Chem.*, 1940, **245**, 334—340).—Thermal decomp. of $[Cr(NH_3)_6]Br_3$ at 300—415° occurs approx. according to the equation $10[Cr(NH_3)_6]Br_3 \rightarrow 6NH_4Br + N_2 + 52NH_3 + 4CrBr_3 + 6CrBr_2$. The residue of $CrBr_3$ and $CrBr_2$ on treatment with Et_2O yields $CrBr_2OEt$ (cf. A., 1930, 1019). The residual $CrBr_3$ reacts very vigorously with H_2O, MeOH, and EtOH with evolution of heat, indicating that it is the active modification (cf. Birk, *Z. angew. Chem.*, 1928, **41**, 32). With Et_2O, however, it reacts no more vigorously than the ordinary modification. J. W. S.

Metal carbonyls. XXXIII. Iron carbonyl iodide. XXXIV. System ferrous iodide–carbon monoxide. Course of the interaction of a gas with a solid. XXXV. Iridium carbonyl. W. Hieber and H. Lagally (*Z. anorg. Chem.*, 1940, **245**, 295—304, 305—320, 321—333).—XXXIII. Thermal decomp. of $Fe(CO)_4I_2$ (I) in an inert gas at 200—400° yields principally FeI_2 and CO but also gives rise to $Fe(CO)_2I_2$ (II) (especially in H_2) and to $Fe(CO)_2I$ and FeI (especially in CO_2 and N_2). (II) is also formed when (I) is heated at 80°, either alone or in a solvent (C_6H_6 or *cyclo*hexane) and on interaction of I with $Fe(CO)_5$. The existence of the compounds containing only one I atom is attributed to the non-polar character of the Fe–I linkage and analogous compounds of other halogens are not to be expected.

XXXIV. Interaction of FeI_2 with CO at 18—20° to yield $Fe(CO)_4I_2$ reaches equilibrium in 15 hr. at 120 atm. with 80% yield. The yield obtained varies linearly with log p (p = pressure of CO) and the results indicate that no reaction occurs at $p < \sim 5{\cdot}6$ atm. This behaviour, apparently contrary to the phase rule, is attributed to surface phenomena arising through the different mol. vols. of FeI_2 and $Fe(CO)_4I_2$. Tests on preps. obtained by treating FeI_2 in Et_2O with CO under high pressure indicate that its decomp. pressure at room temp. is 6·1—6·3 atm.

XXXV. When dry $IrCl_3$, $IrBr_3$, or IrI_3 is heated with Cu or Ag in CO at 140°/350 atm. *Ir tricarbonyl*, $Ir(CO)_3$, is formed as canary-yellow cubic crystals. Under similar conditions $(NH_4)_2IrCl_6$, Na_2IrCl_6, and K_2IrCl_6 yield a mixture of $Ir(CO)_3$ and *Ir tetracarbonyl*, $Ir(CO)_4$, separable by utilising the slight solubility of $Ir(CO)_4$ in CCl_4. When K_2IrBr_6 is heated in CO at 125°/200 atm. and the product sublimed in CO, *Ir tricarbonyl bromide*, $Ir(CO)_3Br$, is formed as brown scales. This suggests that the reactions all proceed through the formation of carbonyl halides. Action of Cl_2 on $Ir(CO)_3$ at 200° yields crystals of the *compound* $Ir_3(CO)_4Cl_2$. If moist $IrCl_3$ is heated in CO at high pressure a volatile compound is produced which when passed through a strongly heated tube deposits an Ir mirror, suggesting the presence of $IrH(CO)_4$. The analogy between the Ir and Co compounds is discussed. J. W. S.

Periodic corrosion of iron in polyphase systems.—See B., 1942, I, 270.

X.—ANALYSIS.

Spectrum analysis. Review of progress. W. Seith (*Z. Elektrochem.*, 1942, **48**, 33—36). C. R. H.

Quantitative Raman spectral analysis. J. Goubeau and L. Thaler (*Angew. Chem.*, 1941, **54**, 26—27).—General methods of quant. analysis based on the Raman spectrum are described. In the first method, the difference in blackening of two lines is determined by a spectrophotometer. From this difference for a given pair of lines from mixtures of known composition, calibration curves are drawn, whence the composition of unknown mixtures can be determined. Investigation of the method with the system amylene hydrate–Bu$^{\gamma}$OH indicates the existence of two systematic errors. The blackening difference depends not only on the concn. of substances in the mixture, but also on the time of illumination and on the continuous background. The method can, therefore, be used only when the calibration and analysis are carried out under the same conditions. The second method uses comparison of intensities; the effect of the continuous background is eliminated, and no systematic error occurs. The dependence of the intensity ratio on the concn. is discussed. The application of the method to ternary mixtures is considered. A. J. M.

Colorimetric analysis. O. H. Weber (*Angew. Chem.*, 1941, **54**, 56—57).—A survey of methods for the determination of dyes and inorg. compounds. J. L. E.

Action of indicators. L. G. S. Brooker (*J. Chem. Educ.*, 1941, **18**, 245—246; cf. A., 1941, I, 126).—Resonance mechanisms explaining the indicator action of Me-orange and the halochromism of 2-*p*-dimethylaminostyrylquinoline are suggested. L. S. T.

Horticultural applications of microchemical analysis.—See B., 1942, III, 147.

Chemical reactions in very dilute aqueous solutions. Z. Karaoglanov (*Kolloid-Z.*, 1941, **95**, 43—58).—Data are recorded showing the relation between sensitivity of pptn. and colour reactions of inorg. ions and quantity of reagent used, presence of foreign electrolytes, p_H, solubility and physical condition of the ppt., fluorescence, opalescence, and other factors. F. L. U.

Mordant dyes and organic reagents for metals. G. N. Copley (*Ind. Chem.*, 1941, **17**, 307—309).—In both cases the substance must have an acidic H atom, usually present as OH, replaceable by a metal; this H must be capable of taking part in a 5- or 6-membered chelate ring, and if the ring contains double bonds these must be conjugated and resonance should be possible in the chelate rings. A. R. P.

Determination of bromides in presence of other halides. P. L. Kapur, M. R. Verma, and B. D. Khosla (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 157—158).—Br, liberated by aq. $H_2CrO_4 + HNO_3$, is extracted with CCl_4 and I liberated therewith from KI is titrated with $Na_2S_2O_3$. I′ is oxidised to IO_3', and only excessive amounts of Cl′ interfere. L. S. T.

Determination of bromides in presence of chlorides. M. Lane (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 149).—Free Br is liberated by addition of aq. Cl_2, and the colour of the aq. solution measured photo-electrically. L. S. T.

Determination of iodine in periodates. R. K. Bahl, S. Singh, and N. K. Bali (*J. Indian Chem. Soc.*, 1941, **18**, 587—588).—I evolved by heating is titrated with $Na_2S_2O_3$. Theoretical results are obtained for Ce, Y, and Cu periodates. F. L. U.

Determination of iodine in desiccated thyroid.—See B., 1942, III, 156.

Phosphate separation in qualitative analysis. J. Reilly and M. O'Brien (*Sci. Proc. Roy. Dublin Soc.*, 1942, **22**, 447—458).—The procedures recommended by Curtman (A., 1936, 951) and Pittmann (A., 1940, I, 444) have been tested critically and their disadvantages are enumerated. An amended technique is based on pptn. with NH_4Cl and $ZrOCl_2$. The slight excess of Zr is pptd. in group III and is separated with Fe but does not interfere with the detection of Fe. This procedure causes practically no loss of cations. J. W. S.

Determination of hypophosphites by potassium permanganate. J. R. Pound (*J.C.S.*, 1942, 307).—Hypophosphites are oxidised by $KMnO_4$ in dil. H_2SO_4, with a little KBr (catalytic action) at room temp.; after 2—3 hr., $FeSO_4$ is added and the excess titrated. A. T. P.

Colorimetric determination of phosphorus in soils.—See B., 1942, III, 145.

Determination of argon in oxygen–nitrogen mixtures. K. G. Zimmer (*Angew. Chem.*, 1941, **54**, 33—35).—A review of physical methods. A. J. M.

Colorimetric determination of silver with 2-thio-5-keto-4-carbethoxy-1 : 3-dihydropyrimidine. J. H. Yoe and L. G. Overholser (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 148—149).—This compound (I) gives the following reactions in addition to those reported previously (A., 1936, 1000): in neutral solutions, $Co^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, pink colours; $Hg^{\cdot\cdot}$, pink ppt.; and $Tl^{\cdot}$, blue ppt.; in aq. HNO_3, $Au^{\cdot\cdot\cdot}$ and $Hg^{\cdot}$, pink ppts.; and $Pd^{\cdot\cdot}$, a slight, red ppt.; in HNO_3–NaOAc buffer, $Ag^{\cdot}$, purple colour and ppt.; $Au^{\cdot\cdot\cdot}$ and $Pd^{\cdot\cdot}$, orange colour and ppt.; $Hg^{\cdot}$ and $Hg^{\cdot\cdot}$, pink colour and ppt. The purple compound with $Ag^{\cdot}$ and (I) can be used for the colorimetric determination of $Ag^{\cdot}$ (procedure described). $Hg^{\cdot}$ and $Hg^{\cdot\cdot}$ must be absent, and limiting concns. of other interfering ions are $Co^{\cdot\cdot}$, 3·5 mg.; $Cu^{\cdot\cdot}$, 1 mg.; $Fe^{\cdot\cdot\cdot}$, 2 mg.; and $Ni^{\cdot\cdot}$, 1·5 mg. SO_4'' and $NH_4^{\cdot}$ increase the intensity of colour. On the spot plate, the sensitivity is 0·25 μg. per 0·05 ml., and in aq. solution, 0·15 μg. L. S. T.

Analysis of calcium carbonate.—See B., 1942, I, 262.

Analysis of solutions containing zinc hydroxide and sodium hydroxide. S. M. Mehta and M. B. Kabadi (*J. Univ. Bombay*, 1941, **10**, *Part* 3, 69—71).—The solution is treated with a known vol. of standard H_2SO_4 and made up to a definite vol., Zn and excess of H_2SO_4 being determined volumetrically [$K_4Fe(CN)_6$; aq. NH_3 + Me-red]. F. J. G.

Spectrochemical determination of lead, calcium, and zinc in dusts, fumes, and ores.—See B., 1942, I, 272.

Determination of copper in presence of iron. P. L. Kapur and Badar-ud-Din (*J. Indian Chem. Soc.*, 1941, **18**, 585—586).—The Cu is determined iodometrically after reduction of Fe^{III} to Fe^{II}. Since the oxidation of Fe^{II} by I is reversible, any of the liberated I lost in this way is recovered towards the end of the final $Na_2S_2O_3$ titration. F. L. U.

Photographic emulsions as specific reagents for traces of mercury and copper. A. Steigmann (*J.S.C.I.*, **61**, 51—52).—The fading of latent images on exposed emulsions in presence of traces of $Hg^{\cdot\cdot}$ ions is used to detect 0·0015 μg. Hg as $Hg^{\cdot\cdot}$. Aq. Na_2SO_3 is added to prevent interference by $Fe^{\cdot\cdot\cdot}$, $Cu^{\cdot\cdot}$, and $Ce^{\cdot\cdot\cdot\cdot}$. Traces of Cu in spots in photographic paper bases are detected by adding small

amounts of $SH{\cdot}CH_2{\cdot}CO_2H$ to the coating emulsion. After drying, exposure, and development the Cu spots appear white and may be verified as Cu by the use of rubeanic acid. S. B.

Spectrochemical analysis of duralumin-type alloys.—See B., 1942, I, 273.

Ceric sulphate in the determination of iron using the molybdisilicic (silicomolybdic) acid method. A. C. Titus and C. W. Sill (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 121).—$Ce(SO_4)_2$ and *o*-phenanthroline-Fe^{II} are substituted for $K_2Cr_2O_7$ and *o*-$NHPh{\cdot}C_6H_4{\cdot}CO_2H$, respectively, in the method described previously (A., 1941, I, 388). L. S. T.

Reaction of ferric ion with orthophosphate in acid solution with thiocyanate as an indicator for ferric ions. O. E. Lanford and S. J. Kiehl (*J. Amer. Chem. Soc.*, 1942, **64**, 291—296).—The reaction between $Fe^{...}$ and HPO_4'' ions has been studied using CNS′ ions as indicator for $Fe^{...}$. The reversible reaction is $Fe^{...} + HPO_4'' \rightleftharpoons FeHPO_4^{\cdot}$. $FeHPO_4^{\cdot}$ has a dissociation const. of $4{\cdot}44 \times 10^{-10}$ at an ionic strength of 0·665 and 30°. The relationship between the extinction coeff. and the molar concn. of $FeCNS^{..}$ ions at 5500 A. has been established. W. R. A.

XI.—APPARATUS ETC.

Determination of critical temperatures by the rotating bomb. V. N. Ipatieff and G. S. Monroe (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 171—174).—A method for determining crit. temp. to within ±2° by means of the rotating bomb is described. Data for C_2H_6, C_3H_8 and H_2, C_6H_{14}, C_6H_{14} and H_2, *cyclo*hexane (**I**), (**I**) and H_2, C_6H_6, C_6H_6 and H_2, $CH_4 + C_6H_6$, and $C_6H_{14} + C_6H_6$, are recorded. The pressure–temp. curves of two-component systems show points of discontinuity similar to those shown by single substances, and the crit. temp. of the systems lie probably within the break on the curves. L. S. T.

Determination of the humidity of the air by means of the evaporation temperature of water. K. Oswatitsch (*Physikal. Z.*, 1941, **42**, 343—347).—Theory and technique are given. A. J. M.

Two bridge-controlled thyratron thermostats. D. Bancroft (*Rev. Sci. Instr.*, 1942, **13**, 114).—Errors in diagrams (A., 1942, I, 155) are pointed out. A. A. E.

Effect of [variations in] colour vision on temperature measurement with the Bioptix pyrometer. S. Fornander (*Jernkont. Ann.*, 1941, **125**, 67—80).—Four normal and one green-colour-blind observers measured temp. with four Bioptix pyrometers (Öhman, *ibid.*, 1935, **119**, 343). All obtained similar vals. with the same instrument, but different instruments gave widely varying results. A very green-colour-blind observer obtained vals. 200—300° apart with the same instrument. M. H. M. A.

Phase-contrast microscopy. C. R. Burch and J. P. P. Stock (*J. Sci. Instr.*, 1942, **19**, 71—75).—A method for adapting an ordinary microscope for the use of Zernike's phase-contrast illumination is described. It involves the provision of a slit source and the prep. and mounting of a phase-accelerating strip etched $\lambda/2$ deep in a glass plate. A. A. E.

***X*-Ray microscope.** (Sir) W. L. Bragg (*Nature*, 1942, **149**, 470—471).—Simplifications and improvements in the optical method previously reported (A., 1939, I, 389) for summing a double Fourier series and so producing an image of a crystal structure are described and illustrated by reference to diopside and hæmoglobin. A. A. E.

Simple recording spectrophotometer. G. A. Boutry and J. Gillod (*Compt. rend.*, 1941, **213**, 235—238).—The difficulties of the const.-deviation method or differential methods with two cells are avoided by a simple arrangement using a new photo-emissive cell (cf. A., 1939, I, 538) and single-stage amplification in conjunction with a double monochromator. Amplified photo-electric currents are recorded directly as a function of λ and are measured by means of a galvanometer. Curves obtained are given and discussed. N. M. B.

Blank and background effect on photographed spectral lines. L. W. Strock (*J. Opt. Soc. Amer.*, 1942, **32**, 103—111).—A detailed discussion of the establishment of calibration curves for the determination of Sr in powdered lepidolite, using Li as internal standard. O. D. S.

Application of a calculating board to quantitative spectroanalysis. C. King (*J. Opt. Soc. Amer.*, 1942, **32**, 112—115).—A graphical method, of converting densitometer readings into concn. ratios, applicable to the internal standard method of spectrochemical analysis, is described. O. D. S.

Photo-electric fluorimeters and their uses. G. F. Lothian (*J.S.C.I.*, 1942, **61**, 58—60).—A description is given of the Spekker photo-electric fluorimeter. The use of this and similar instruments is considered and the effects of concn. of solution and of impurities on accuracy of estimation are considered.

Spectrographic analysis. Relationship between photographic contrast and wave-length for the Ilford ordinary plate in the ultra-violet. A. C. Coates and E. H. Amstein (*J.S.C.I.*, 1942, **61**, 65—66).—A curve between photographic contrast, γ, and wave-length, λ, is given for the Ilford Ordinary plate. The contrast is obtained from density/log relative intensity plots, using a stepped sector to give known relative intensities. The γ/λ curve shows that γ is const. between 2500 and 3100 A. (cf. A., 1942, I, 156). By the use of the stepped sector the formula given for calculating the error incurred in comparing two spectrum lines in λ regions of differing contrast (*loc. cit.*) is shown to hold satisfactorily.

Photometry. H. Buckley (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 318—337).—A progress report. W. J.

Photo-electric colorimeter for rapid reactions. B. Chance (*Rev. Sci. Instr.*, 1942, **13**, 158—161).—With the differential photo-electric colorimeter described small absorption changes in enzyme–substrate reactions can be measured with an accuracy of 3% and a time resolution of 0·01 sec. A. A. E.

Colorimetry in metallurgical analysis.—See B., 1942, I, 271.

Specimen holder for powder diffraction samples. A. A. Burr (*Rev. Sci. Instr.*, 1942, **13**, 127—128).—Background fog from Pyrex is avoided by using Cellophane specimen tubes. A. A. E.

Instrumental technique in astrophysics. A. Hunter (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 186—199).—A progress report. W. J.

Electron microscope for accelerating potentials of 220 kilovolts. H. O. Müller and E. Ruska (*Kolloid-Z.*, 1941, **95**, 21—25).—Electron-micrographs are reproduced to illustrate the improvement in detail obtained by the use of higher electron velocities up to 220 kv. The construction and use of the instrument are described. F. L. U.

Thermostable and durable support film for electron diffraction and electron-microscopic investigations. G. Hass and H. Kehler (*Kolloid-Z.*, 1941, **95**, 26—29).—The use of Al_2O_3 films removed from the oxidised surface of Al is described. These films give very weak interference patterns which do not seriously compete with those of the material under examination and are unaffected by temp. >500°. F. L. U.

Alternating-current apparatus for measuring dielectric constants. B. E. Hudson and M. E. Hobbs (*Rev. Sci. Instr.*, 1942, **13**, 140—143).—A heterodyne beat apparatus is described. A. A. E.

Research with the polarograph. O. H. Müller (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 99—105).—A summary of uses. L. S. T.

Polarographic reading directly in percentage. Analysis of lead arsenate. B. P. Caldwell and S. Reznek (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 187—189).—A manually-operated polarograph to give direct % readings is described. Application to the analysis of commercial Pb arsenate is given. L. S. T.

Micro-burette. P. F. Scholander (*Science*, 1942, **95**, 177—178).—Hg is replaced by the spindle of a micrometer. An accuracy in delivery of 0·1 cu. mm. is claimed. E. R. R.

Dumas micro-method for nitrogen. Automatic apparatus for combustion micro-methods.—See A., 1942, II, 183.

Adjustable resistor for flowmeters. E. L. Gooden (*Science*, 1941, **94**, 309—310).—The resistance to flow in a capillary is adjusted by means of a movable, exchangeable wire. E. R. R.

Test-tube spiral absorption vessel. R. E. Girton (*Science*, 1942, **95**, 25—26).—A simple efficient CO_2-absorption vessel, suitable for plant respiration measurements, is described in detail. E. R. R.

Molecular still heads. A. J. Bailey (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 177—178).—A mol. still made from two standard Pyrex micro-bell jars, and a larger still made in a standard Pyrex vac.-distilling dome, are described and illustrated. L. S. T.

Theory of open-tube distillation columns.—See B., 1942, I, 249.

Plate yield and determination of dimensions of elements of distilling and rectifying columns.—See B., 1942, I, 249.

Progress in microchemistry. III. Preparative micro-technique. E. Pfeil (*Angew. Chem.*, 1941, **54**, 161—167).—A review. C. R. H.

Determination of solubilities of gases at high temperatures and high pressures by the rotating bomb. V. N. Ipatieff and G. S. Monroe (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 166—171).—A rotating bomb for determining solubilities and crit. temp., and sampling apparatus for determining solubilities, are described. The results obtained show that the bomb can be used for determining solubilities of gases at high pressures and at temp. approaching the crit. temp. Pressure is the chief factor affecting the solubility of CH_4 in C_6H_6; the effect of temp. is of minor importance. Both temp. and pressure exert a marked effect on the solubility of C_3H_8 in C_6H_6. Results with SO_2 in C_6H_6 are also recorded. L. S. T.

Continuous washing apparatus for solutions in organic solvents. A. L. LeRosen (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 165).—A const. air space is maintained in a separating funnel while a stream of H_2O is passed through the solvent. L. S. T.

Pressure-regulating and indicating apparatus for vacuum systems. B. Ferguson, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 164—165).—Apparatus incorporating an automatically-controlled air leak, and accurate to $\pm 0{\cdot}2$ mm. for pressures of 5—760 mm., is described. A closed-end manometer also is illustrated. L. S. T.

Adjustable safety shield. A. Furst (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 158). L. S. T.

Sublimation apparatus. O. A. Nelson (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 153).—The concave inner tube is fitted with a German-silver mesh screen to catch falling particles of the sublimate. L. S. T.

Determining liquid and vapour densities in closed systems. G. H. Wagner, G. C. Bailey, and W. G. Eversole (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 129—131).—The method uses a quartz bob suspended from a quartz helix. V.d. of SO_2 in equilibrium with its solutions at 15°, 20°, and 25° determined by this method agreed with v.d. calc. from v.p. data to 0·00001 g. per c.c. L. S. T.

Continuous liquid extractor for large volumes of solution. R. Hossfeld (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 118).—Vigorous agitation and continuously recirculated dispersion of the solvent through the layer being extracted are achieved. L. S. T.

Electrically driven high-speed laboratory centrifuge. E. G. Pickels (*Rev. Sci. Instr.*, 1942, **13**, 93—100).—The instrument utilises a direct universal motor drive capable of spinning an 8-in. rotor at 18,000 r.p.m. for 180 v. and at 12,500 r.p.m. for 115 v. Specifications and operational data are given for rotors of diameter 7—10·25 in. and capacities 112—610 c.c. of fluid. A. A. E.

Stress analysis and design of high-speed angle centrifuges. E. G. Pickels (*Rev. Sci. Instr.*, 1942, **13**, 101—114).—A graphical method for determining mechanical stresses is explained and equations leading to approx. vals. are given. Design is discussed. A properly designed rotor of diameter 20 cm. and accommodating several hundred c.c. of fluid can operate at speeds $>$50,000 r.p.m. for thousands of runs. A. A. E.

High-speed centrifuging. J. W. Beams (*Physical Soc. Rep. Progr. Physics*, 1941, **8**, 31—49).—A progress report. W. J.

Analytical cell for the ultracentrifuge. M. Rosenfeld (*Rev. Sci. Instr.*, 1942, **13**, 154—157).—The cell is divided into 2 or 3 compartments by sieve-like partitions covered with filter-paper and is used with the angle type quantity rotor of the air-driven ultracentrifuge. A. A. E.

Apparatus for supersonic velocity and absorption measurements. D. Telfair and W. H. Pielemeier (*Rev. Sci. Instr.*, 1942, **13**, 122—126).—Apparatus and technique are described. The velocity of low-frequency sound in dry air (0·03% CO_2) at 0° and 1 atm. is $331{\cdot}45 \pm 0{\cdot}05$ m. per sec. Experimental results for C_3H_8 and CH_4 are briefly reviewed. A. A. E.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Demonstration of *cis–trans* isomerism [using dimethyl maleate and bromine in light]. O. Grummitt (*J. Chem. Educ.*, 1941, **18**, 477). L. S. T.

Dynamos and electrochemistry. G. Eger (*Z. Elektrochem.*, 1942, **48**, 1—6).—Commemorative. C. R. H.

Samuel Higley, an early American metallurgist. F. H. Getman (*J. Chem. Educ.*, 1941, **18**, 453—457). L. S. T.

XIII.—GEOCHEMISTRY.

Limnological studies of Lake Erie. II. Light penetration with relation to turbidity. D. C. Chandler (*Ecology*, 1942, **23**, 41—51). L. G. G. W.

Salesite ($CuIO_3OH$) and olivine (Mg_2SiO_4). H. Strunz (*Z. Krist.*, 1941, **103**, 359—360).—The structures of salesite (cf. Palache and Jarrell, A., 1939, I, 542) and olivine are isotypical; true isomorphism is unlikely. A. J. E. W.

Celestite in Cis-Indus Salt Range [near Jaba]. B. S. Lamba (*Current Sci.*, 1942, **11**, 54—55). W. R. A.

Yorkshire Dogger. II. Lower Eskdale. R. H. Rastall and J. E. Hemingway (*Geol. Mag.*, 1941, **78**, 351—370). L. S. T.

Origin of strontianite deposits in the Münster district. F. Micklinghoff (*Glückauf*, 1942, **78**, 217—220, 229—235).—Analyses. R. B. C.

Pyroxenes of common mafic magmas. I, II. H. H. Hess (*Amer. Min.*, 1941, **26**, 515—535, 573—594).—The pyroxenes of fine- and coarse-grained mafic intrusives and of mafic extrusives are described. Hypotheses concerning the trend of crystallisation of pyroxenes from basalts are reviewed. Augite (**I**) probably does not grade into pigeonite (**II**), which is probably a definite and distinct mineral variety. (**I**) and (**II**) crystallise together and in equilibrium with each other. On slow cooling, (**II**) inverts to hypersthene (**III**), and this inversion can be used as a point on the geological thermometer. (**III**) inverted from (**II**) can be distinguished from (**HI**) of primary crystallisation. The temp. of basaltic intrusions is $>$1140°, and normally is near to 1120°. L. S. T.

Validity of paragonite as a mineral species. W. T. Schaller and R. E. Stevens (*Amer. Min.*, 1941, **26**, 541—545).—Alkali determinations on mica from Fenestrella, Italy, and from Monte Campione, Switzerland, and on euphyllite from Corundum Hill, Pa., show that paragonite (**I**) is a definite species. Optical differentiation between (**I**) and muscovite is not possible. L. S. T.

Nepheline. A. N. Winchell (*Amer. Min.*, 1941, **26**, 536—540).—The composition of nephelines in mol.-% of $NaAlSiO_4$, $KAlSiO_4$, $CaAlAlO_4$, $SiSiO_4$, $AlSiO_3(OH)$, and $CaCaSiO_4$, as calc. from recent chemical analyses, is tabulated and discussed. L. S. T.

Valentinite crystals from California. J. Murdoch (*Amer. Min.*, 1941, **26**, 613—616).—Valentinite crystals from Lone Tree Canyon, Kern Co., California, show an unusual lath-like habit. New crystallographic forms are described. L. S. T.

Sedimentary analcite. C. S. Ross (*Amer. Min.*, 1941, **26**, 627—629).—Analcite from Wikieup, Arizona, is described. It is derived from glassy volcanic ash. L. S. T.

Shortite. Correction of space-group. W. E. Richmond (*Amer. Min.*, 1941, **26**, 629—630).—The space-group is C_{2v}^{14}—*Amm*2 (cf. A., 1941, I, 490). L. S. T.

Structural control and form of oreshoots in the southern Appalachian gold deposits. C. F. Park, jun. (*Econ. Geol.*, 1939, **34**, 470).—Descriptive. L. S. T.

Geology of the Ropes Gold mine, Marquette Co., Michigan. T. M. Broderick (*Econ. Geol.*, 1939, **34**, 939—940).—The ore occurs in nearly vertical quartz (**I**) lenses cutting Keewatin lavas and volcanic fragments separating two bodies of peridotite. The mineralisation is probably post-middle Huronian. The (**I**) veins carry tetrahedrite, pyrite, chalcopyrite, and minor amounts of other sulphides. Another type of richer ore occurs as a pyritic dissemination in schist adjacent to the (**I**) veins. L. S. T.

Peridotite and sagvandite from south Madagascar. A. Lacroix (*Compt. rend.*, 1941, **213**, 261—265).—Occurrence is described, and chemical analyses are recorded. L. S. T.

Trachyandesite with kaersutite and cristobalite among the lavas of the Puy chain. Y. Bentor (*Compt. rend.*, 1941, **213**, 211—214).—Chemical and mineral analyses are given. L. S. T.

Fluorescent sodalite and hackmanite from Magnet Cove, Arkansas. H. D. Miser and J. J. Glass (*Amer. Min.*, 1941, **26**, 437—445).—Two varieties of fluorescent sodalite (**I**) occur in the tinguaite rocks of Magnet Cove, a blue (**I**) that fluoresces purplish-red to violet-red, and a white variety, hackmanite (**II**), that fluoresces a reddish-orange, and shows a change of colour from rose to colourless and back again with alternate exposure to light and darkness. Reappearance of the rose colour is induced by exposure to ultra-violet radiation; the colour disappears in daylight. Chemical analyses of (**I**) and (**II**) are compared with those of specimens from other localities. (**I**) and (**II**) from Magnet Cove have approx. the same composition; (**II**) contains a trace of sulphide, and (**I**), a small amount of Mn. L. S. T.

Metasomatism of a coaly sediment into an igneous-appearing rock. G. E. Goodspeed, R. E. Fuller, and H. A. Coombs (*J. Geol.*, 1941, **49**, 190—198; cf. A., 1940, I, 239).—In Mount Rainer National Park, seams of lignitic material occur locally in a thick series of arkosic sandstones and shales. Some members of this series have been altered by low-temp. metasomatic replacement to resemble portions of an andesitic series of the Miocene. The carbonaceous material is replaced by an igneous-appearing dacitic groundmass containing quartz and plagioclase. L. S. T.

Petrified tree-trunks (dolomitised sphaerolite-wood) in the coal formation of the Ruhr district. P. Kukuk and W. Hartung (*Glückauf*, 1941, **77**, 698—703).—The dolomitic remains of trunks are so-called sphaerolite-wood similar to that from the brown coal of Ville. They differ in their allochthonous occurrence. Analyses are given. R. B. C.

Petrified coal. W. Petrascheck (*Berg- u. Hüttenm. Monatsh.*, 1941, **89**, 148—150; *Glückauf*, 1942, **78**, 71).—Coal seams can be so saturated by mineral matter percolating from without as to be converted in effect into rock. R. B. C.

Coal district of Nürschan near Pilsen. W. May (*Glückauf*, 1942, **78**, 29—31).—Geological. R. B. C.

Geology of British oilfields. III. Oilfields of Burma. P. Evans and C. A. Sansom (*Geol. Mag.*, 1941, **78**, 321—350).—History, geology, and the various fields are described. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

AUGUST, 1942.

I.—SUB-ATOMICS.

Radiation from carbon arcs. H. G. MacPherson (*J. Appl. Physics*, 1942, **13**, 97—102).—The radiation characteristics of the low- and high-intensity C arcs and of the flame arc are described, and the processes which determine them are discussed. O. D. S.

Persistent lines in arc spectra. J. M. López de Azcona (*Inst. Geol. Min. España*, 1941, **8**, 171—187).—Lines persisting at 5×10^{-4} to 5×10^{-9} g. for the 70 elements which give arc spectra have been redetermined. F. R. G.

Spectrum analysis. Review of progress.—See A., 1942, I, 247.

Triplets of helium. D. R. Inglis (*Physical Rev.*, 1942, [ii], **61**, 297—302).—The inversion of the He triplets and their deviation from interval rule are due to spin–other-orbit and to spin–spin interactions, respectively. Heisenberg's preliminary calculation is compared with Breit's correct calculation for the lowest triplet (cf. A., 1932, 441). Araki's extension to higher triplets (cf. *Proc. Phys. Math. Soc. Japan*, 1937, **19**, 128) is simplified and generalised, and comparison with experiment is discussed. N. M. B.

Term formulæ for the configuration d^5. O. Laporte (*Physical Rev.*, 1942, [ii], **61**, 302—304).—Formulæ for the case of Russell–Saunders coupling are reported for the first time. Although several terms appear more than once and so should depend irrationally on the radial integrals, only two of the three ^2D terms do so. The formulæ satisfactorily represent the d^5 terms of Cr II. N. M. B.

Degeneracies among terms of a configuration of equivalent electrons. O. Laporte and J. R. Platt (*Physical Rev.*, 1942, [ii], **61**, 305—308; cf. preceding abstract).—Mathematical. If the radial integrals occurring in the term formulæ for a configuration l^s assume certain integer ratios all elements of the energy matrix become low multiples of a common val.; hence high degeneracies occur. This is due to the existence of an identity concerning sums of products of three integrals of spherical harmonics. The regularity serves in the approx. allocation of energy levels or as a check for exact energy formulæ. Ostrofsky's formulæ for d^4 (cf. A., 1934, 1285) are corr. N. M. B.

Relative *f*-values for lines of Ti II. R. B. King (*Astrophys. J.*, 1941, **94**, 27—29).—Relative *f*-vals. for 63 lines in 17 multiplets of Ti II in the range 3143—3761 A. are obtained from measurements of the total absorptions of lines of Ti in the electric furnace at temp. up to 3000°. E. R. R.

Solar corona. M. N. Saha (*Nature*, 1942, **149**, 524—525).—It is suggested that the highly stripped atoms of Fe and Ni which give rise to corona lines are produced in a nuclear reaction, analogous to U fission, occurring in the reversing layer. A. A. E.

Dynamics of the interstellar medium. I. Local equilibrium. L. Spitzer, jun. (*Astrophys. J.*, 1941, **93**, 369—379). E. R. R.

Spectrum of the shell of Pleione. O. Struve and P. Swings (*Astrophys. J.*, 1941, **93**, 446—452). E. R. R.

Visual spectrum of Pleione. J. L. Greenstein (*Astrophys. J.*, 1941, **93**, 453—454). E. R. R.

Emission lines in spectra of B1985 and WY Geminorum. P. Swings and O. Struve (*Astrophys J.*, 1941, **93**, 455—460; cf. A., 1941, I, 310). E. R. R.

Radiation pressure in the convective stellar model. L. R. Henrich (*Astrophys. J.*, 1941, **93**, 483—501). E. R. R.

Mean absolute magnitudes of stars of spectral types O5—B5. R. E. Wilson (*Astrophys. J.*, 1941, **94**, 12—20). E. R. R.

Physical processes in gaseous nebulæ. XVI. Abundance of O III. XVII. Fluorescence in high-excitation planetaries. D. H. Menzel and L. H. Aller (*Astrophys. J.*, 1941, **94**, 30—36, 436—448).—XVI. The density of O III ions, as determined from the abs. intensities of the green nebular lines of O III 5007, 4959, and 4363 A., is ~1 per c.c. This abundance, though only ~0·0001 of that of H ions, is sufficient to produce marked depression of temp. through collisional excitation. Observed electron temp. are consistent with earlier theory.

XVII. Bowen's explanation of the appearance of "fractional multiplets" of O III in the spectra of high-excitation planetaries is tested quantitatively by predicting relative intensities of the ultraviolet lines from suitable equations of statistical equilibrium for the excited levels. Consistent agreement with the observed vals. is found. The non-appearance of permitted O III lines and the magnitude of the He II lines are explained. Relevant vals. for *f* and *A*, computed from approx. (Slater) wave-functions, are tabulated. E. R. R.

Spectrophotometry of 67 bright stars with a photo-electric cell. J. S. Hall (*Astrophys. J.*, 1941, **94**, 71—93). E. R. R.

β-Canis Majoris. O. Struve and P. Swings (*Astrophys. J.*, 1941, **94**, 99—108). E. R. R.

Spectrum of HK Scorpii. C. T. Elvey (*Astrophys. J.*, 1941, **94**, 140). E. R. R.

Variations of CL and HK Scorpii. (Miss) H. H. Swope (*Astrophys. J.*, 1941, **94**, 141—142). E. R. R.

Spectrographic study of the eclipsing variable WW Draconis. A. H. Joy (*Astrophys. J.*, 1941, **94**, 407—411). E. R. R.

The grating infra-red solar spectrum. V. Atomic lines in the far infra-red. VI. Map from 14 μ. to 7 μ. A. Adel (*Astrophys. J.*, 1941, **94**, 449—450, 451—467).—V. Six intense lines are tentatively correlated with the transitions $3D$–$3P$ for Na I and $6P$–$5D$ for K I.

VI. A map of the infra-red spectrum, showing actual resolving power of 1 cm.$^{-1}$ throughout, with tables of $\lambda\lambda$ and $\nu\nu$, is given. E. R. R.

Classification of red carbon stars. P. C. Keenan and W. W. Morgan (*Astrophys. J.*, 1941, **94**, 501—510). E. R. R.

Hydrogen emission in 25 Cygni. W. A. Hiltner (*Astrophys. J.*, 1941, **94**, 548). E. R. R.

Inverse Stark effect and electrical double refraction. F. Gabler (*Physikal. Z.*, 1941, **42**, 67—72).—The inverse Stark effect, and the transverse electrical double refraction in the neighbourhood of certain absorption lines which accompanies it, have been investigated for Na and K. An at. beam was used as an absorbing layer. Double refraction was observed with the Na D_2 line but not with the D_1 line. The latter suffers displacement only in an electric field. The corresponding K line (7645 A.) also shows no electrical double refraction. A. J. M.

***X*-Ray absorption structure as a tool in physics and chemistry.** S. T. Stephenson (*J. Appl. Physics*, 1942, **13**, 142—146). A. J. E. W.

***X*-Ray *L*-series satellite lines.** L. Pincherle (*Physical Rev.*, 1942, [ii], **61**, 225—233; cf. Randall, A., 1940, I, 276).—The $L\alpha$ and $L\beta$ satellites are ascribed to doubly ionised atoms, and $\lambda\lambda$ and relative intensities are calc. by the self-consistent field method. Computed and observed satellite profile structures are compared. Full data and separations are tabulated, and a proposed classification of experimental component lines in terms of theoretical transitions is given. N. M. B.

Auger effect in relative intensities and widths of *X*-ray lines. J. N. Cooper (*Physical Rev.*, 1942, [ii], **61**, 234—242).—A two-crystal spectrometer study of certain *L* lines in the range $Z = 70$—81 shows that for ^{72}Ta—^{81}Tl the widths of lines from L_I initial states increase in energy by ~6 e.v., and the widths of lines from L_{II} and L_{III} initial states increase by ~1 e.v.; intensities of L_I lines relative to intensities of L_{II} and L_{III} lines show a marked decrease with *Z*. Both variations can be attributed to the rapid increase with *Z* of the probabilities of the Auger transitions $L_I \rightarrow L_{III}M_{IV}$ and $L_I \rightarrow L_{III}M_V$. Results on line widths accord with the Weisskopf–Wigner theory. Data indicate that Auger transitions are of prime importance in determining the relative intensities and widths of certain *X*-ray lines. N. M. B.

Retardation of electrons at *X*-ray levels. G. Ruthemann (*Naturwiss.*, 1942, **30**, 145).—The velocity spectrum of 7·5-ke.v. electrons after passing through very thin films of collodion shows irregularities at the *K*-ionisation levels of O, N, and C. A. J. M.

Multiple scattering of fast electrons. L. A. Kulchitsky and G. D. Latyshev (*Physical Rev.*, 1942, [ii], **61**, 254—265).—With a special apparatus and Geiger–Müller counters, the scattering of 2·25-Me.v. electrons is studied in foils of Al, Cu, Fe, Mo, Ag, Sn, Ta, Au, and Pb. Results are plotted and compared with Williams' multiple scattering

theory (cf. A., 1940, I, 399). For ^{13}Al—^{30}Zn results coincide with theory; for heavy elements ^{73}Ta, ^{79}Au, and ^{82}Pb, the experimental vals. are 10—13% < calc. N. M. B.

Electron emission of metals in electric fields. III. Transition from thermionic to cold emission. E. Guth and C. J. Mullin (*Physical Rev.*, 1942, [ii], **61**, 339—348; cf. A., 1941, I, 312).—The theory of Schottky emission is extended to include in the current those electrons which tunnel through the top of the potential barrier at the metal surface when fairly strong electric fields are used. These electrons contribute to the periodic deviations from the Schottky line, increasing the amplitude of the deviations in accordance with experiment. This necessitates a very small Nottingham reflexion coeff. for fields $>10^4$ v. per cm. Expressions are developed for the electron current emitted by a metal for field intensities in the thermionic work—cold emission range. Results are obtained for the temp.- and field-dependence of the electron current for relevant ranges including the " transition region." N. M. B.

Angular distribution of positron annihilation radiation. R. Beringer and C. G. Montgomery (*Physical Rev.*, 1942, [ii], **61**, 222—224).—High-resolution counter observations of the angular distribution of the two quanta emitted in the annihilation of a positron and an electron are consistent with the view that the two quanta are emitted in exactly opposite directions to within 1°. The angular half-width of a possible distribution of deviations from strict collinearity is <15′. It is concluded that the momentum balance is accurately maintained by the quanta alone, and that, in general, a positron stops before annihilation in accord with theory. N. M. B.

Distribution in angle of protons from the D–D reaction. H. P. Manning, R. D. Huntoon, F. E. Myers, and V. J. Young (*Physical Rev.*, 1942, [ii], **61**, 371—374).—Angular distribution of the disintegration protons from the D–D reaction, investigated as a function of energy for 60—390 ke.v., is represented by $I(\theta) = 1 + A\cos^2\theta$ at any one energy. The val. of A increases smoothly with bombarding energy over the range. N. M. B.

Chemical elements and naturally occurring atoms from the viewpoint of isotope and nucleus investigation. O. Hahn, S. Flügge, and J. Mattauch (*Ber.*, 1942, **75**, [*A*], 14—16).—An addendum to the report of January, 1940 (cf. A., 1940, I, 185), deals with C, O, Co, Ni, Fe, Yb, and Pb. H. W.

Vapour density method for determination of at. wt. T. Batuecas (*Z. anorg. Chem.*, 1941, **246**, 158—168).—Magnus and Schmid's data (A., 1922, ii, 260) on v.d. of C_6H_6 and $CHCl_3$ have been re-evaluated using a different system of calculation. This leads to 12·0045 ± 0·0008 and 35·460 ± 0·011 as at. wts. of C and Cl, respectively, and confirms that their method is applicable to exact determination of at. wts. J. W. S.

At. wt. of zinc. O. Hönigschmid and M. von Mack (*Z. anorg. Chem.*, 1941, **246**, 363—369).—Pure $ZnCl_2$ was prepared from gaseous HCl and vac.-distilled Zn at 700° and was twice distilled in a current of HCl. The at. wt. of Zn is determined from measurement of the ratio $ZnCl_2 : 2Ag : 2AgCl$. The mean val., 65·377 ± 0·001, confirms the accepted chemical val. and is > the mass-spectrographic val. O. D. S.

Radioactivity and the completion of the periodic system. F. A. Paneth (*Nature*, 1942, **149**, 565—568).—A lecture. A. A. E.

Absorption of the primary β-radiation from radium in lead and platinum and specific γ-ray dose rate at filtration of 0·5 mm. of platinum. G. J. Neary (*Brit. J. Radiol.*, 1942, **15**, 104—109).—The range of β-radiation from Ra in Pt, estimated from measurements on Pb, is 0·53 mm. The β–γ ionisation ratio after 0·50 mm. Pt is ~1%. The mass absorption coeff. of Pt for the hard β component is 7·7 cm.^{2} per g. 1 mg. of Ra filtered by 0·5 mm. Pt gives γ-ray dose rate 8·47 e.s.u. per c.c. per hr. in air. L. J. J.

Activation of lanthanum with neutrons. H. Götte (*Naturwiss.*, 1942, **30**, 108).—Bombardment of La with 15·2-me.v. neutrons gives a product of half-life 44 hr., identical with that obtained by the use of slow neutrons. Experiments on absorption in Al with the ^{140}La (44 hr.) obtained by the use of rapid and slow neutrons, and by fission of U, indicate that all three are identical. A. J. M.

Nuclear levels of ^{5}Li. G. Beck and S. T. Tsien (*Physical Rev.*, 1942, [ii], **61**, 379).—Experimental analysis of the angular and velocity distribution of protons projected by incident α-particles indicates that ^{5}Li has levels with energies 0·56, 0·64, 0·74, 0·83, 0·91, and 1·00 Me.v., with spacing and breadth ~0·1 Me.v. An analysis of these results by Wentzel's criteria is discussed. Agreement with theory is satisfactory. N. M. B.

Nuclear spin and magnetic moment of ^{40}K. J. R. Zacharias (*Physical Rev.*, 1942, [ii], **61**, 270—276).—Because of the small abundance of ^{40}K, a modified apparatus and form of the mol. beam magnetic resonance method are used to observe the nuclear spin and hyperfine structure $\Delta\nu$. The vals. found are spin 4 and $\Delta\nu$ 1285·70 ± 0·1 Mc. The doublet is inverted. By comparison with the known nuclear moment of ^{39}K, that of ^{40}K is −1·290 nuclear magnetons. N. M. B.

γ-Ray transition of the isotope of bromine (^{80}Br) 4·5 hours. A. Krebs (*Naturwiss.*, 1942, **30**, 121).—In the chemical separation of ^{80}Br (18 min.) and ^{80}Br (4·5 hr.), 85% of the unconverted nuclei are found in the ppt. It is concluded that in the case of 85% of the disintegrating nuclei, the γ-quantum suffers an internal transformation. This does not agree with the work of Siday (A., 1941, I, 394). A. J. M.

Radiations from radioactive gold, tungsten, and dysprosium. A. F. Clark (*Physical Rev.*, 1942, [ii], **61**, 242—248; cf. Mitchell, A., 1940, I, 338).—From measurements of β–γ and γ–γ coincidences and known energies of the emitted radiations, level schemes are deduced for Au and W. The β-ray spectrum of ^{198}Au is simple, with an end-point of 0·78 Me.v.; the residual nucleus emits two γ-rays in cascade. ^{197}W has a complex spectrum; the high-energy group max. is 1·4, and the lower-energy group has an end point at 0·5 and is followed by a 0·9-Me.v. γ-ray and other γ-rays which give γ–γ coincidences. The Dy β-ray end-point is 1·2 and the max.-energy γ-ray is 1·1 Me.v. N. M. B.

Theoretical half-lives of β-activities. C. L. Critchfield (*Physical Rev.*, 1942, [ii], **61**, 249—254; cf. A., 1941, I, 439).—Vals. are calc., as a function of the max. energy and the nuclear charge, for forbidden β-transitions in the usual five types of interaction of Fermi's theory of β-decay. The half-lives in most first forbidden and some second forbidden transitions vary approx. as w^{-5} (w = max. energy) as for allowed transitions, but, in general, may be $\propto w^{-7}$ and $w^{-7\text{ or }-9}$, respectively. N. M. B.

Separation of element 93. K. Starke (*Naturwiss.*, 1942, **30**, 107—108).—Preps. have been made by the method of Szilard *et al.* (A., 1934, 1152) in which $^{239}_{92}$U has been enriched 10^5-fold. After the decay of the 23-min. nucleus $^{239}_{92}$U, a further decay of 2·4 days half-life period was found which may be due to a nucleus $^{239}_{93}$El (cf. Macmillan *et al.*, A., 1940, I, 340). A. J. M.

Production of divergent penetrating secondary corpuscles by cosmic rays. P. Auger and J. Daudin (*Compt. rend.*, 1941, **213**, 24—26). A. J. M.

Production and absorption of mesotrons. G. Wataghin (*An. Acad. Brasil. Cienc.*, 1942, **14**, 79—81).

Mesotron component of cosmic rays. H. D. Rathgeber (*Physical Rev.*, 1942, [ii], **61**, 207—211). N. M. B.

Intensities of the hard and soft components of cosmic rays as functions of altitude and zenith angle. K. Greisen (*Physical Rev.*, 1942, [ii], **61**, 212—221). N. M. B.

Mesotron studies with dual telescope. F. A. Benedetto, G. O. Altmann, and V. F. Hess (*Physical Rev.*, 1942, [ii], **61**, 266—269).—The cosmic-ray telescope previously used is described (cf. A., 1942, I, 37), and a more detailed analysis of results is given. N. M. B.

Cloud-chamber track of a mesotron stopped by gas. T. H. Johnson and R. P. Shutt (*Physical Rev.*, 1942, [ii], **61**, 380—381; cf. A., 1942, I, 162). N. M. B.

Internal temperature-density distribution of the sun. G. Blanch, A. N. Lowan, R. E. Marshak, and H. E. Bethe (*Astrophys. J.*, 1941, **94**, 37—45). E. R. R.

Quantum numbers and the periodic table. T. H. Hazlehurst (*J. Chem. Educ.*, 1941, **18**, 580—581). L. S. T.

New key in the interpretation of physics. S. Autúnez de Mayolo (*Bol. Soc. Quim. Peru*, 1942, **8**, 5—28).—An electromagnetic theory based on a helicoidal motion of photons. F. R. G.

Physical interpretation of quantum mechanics. P. A. M. Dirac (*Proc. Roy. Soc.*, 1942, **A, 180**, 1–40).—Bakerian lecture. G. D. P.

Approximate solution of Schrödinger equations by a least-squares method. A. A. Frost (*J. Chem. Physics*, 1942, **10**, 240—245).—Mathematical. W. R. A.

Statistical forces. L. Goldstein (*J. Chem. Physics*, 1942, **10**, 295—297).—A two-particle force in co-ordinate space represents the apparent coupling between two spinless atoms in Bose–Einstein and Fermi–Dirac assemblies at all temp. ≫ their transition temp. L. J. J.

Compressibility and electron volume. H. Koppe (*Z. anorg. Chem.*, 1941, **246**, 131—137).—Biltz and Klemm's relation between the compressibility and electron vol. of metals is derived theoretically from simple assumptions regarding kinetic and exchange energies of electron gas. J. W. S.

II.—MOLECULAR STRUCTURE.

Curve shape index for identification by means of spectrophotometric curves. W. A. Shurcliff (*J. Opt. Soc. Amer.*, 1942, **32**, 160—163).—A method of indexing the absorption curves of dyes is described which enables rapid identification of unknown materials. O. D. S.

Measurements of ultra-violet solar- and sky-radiation intensities in high latitudes. W. W. Coblentz, F. R. Gracely, and R. Stair (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 581—591). A. R. P.

High rotational levels and partition function for hydrogen. H. W. Woolley (*J. Chem. Physics*, 1941, **9**, 470—472).—Inversion of the ordinary rotating-vibrator formula gives improved convergence in the series used for calculating energy of high rotational levels in a diat. mol. L. J. J.

Absorption spectrum of chlorine fluoride. A. L. Wahrhaftig (*J. Chem. Physics*, 1942, **10**, 248).—ClF exhibits a band system at 4800 A. similar to the $^3\Pi_0^+ \rightarrow {}^1\Sigma^+$ system of ICl. Vibrational and rotational analyses are made, and mol. consts. are given. Vals. of the dissociation energy of F_2 and the heat of formation of ClF are deduced. W. R. A.

Nature of electronic levels in ultra-violet spectra of hydrogen and alkyl halides. R. S. Mulliken (*Physical Rev.*, 1942, [ii], **61**, 277—283; cf. A., 1940, I, 285).—The discussions include ICl, IBr, and BrCl. It is concluded that the excited orbital of the H halides is of σ type in the *B,C* bands, but of $p\pi$ type in the *D,E* bands. For the upper level of the *B* and *C* bands the coupling changes from nearly *J,j*-like in the iodides to predominantly *L,S*-like in the chlorides. The tendency towards *L,S*-like coupling is greater in the H than in the alkyl halides. For the *B,C* " satellites " in HCl, a $4p\sigma$ excited orbital is indicated. The *D,E* bands show nearly *J,j*-like coupling for all halides. The natures of the excited orbitals in observed Rydberg series are discussed. Two of the most prominent series start with the *A* continuum and with the *D,E* bands, and so should have σ and $p\pi$ excited orbitals, respectively. The $np\pi$ " non-bonding " orbital in the normal states of the H halides and other diat. hydrides is probably slightly bonding. N. M. B.

Methyl iodide absorption bands near λ 2000. R. S. Mulliken and E. Teller (*Physical Rev.*, 1942, [ii], **61**, 283—296).—The theory of the types and structures of bands in an electronic transition in an axially symmetrical mol. of symmetry C_{3v} is discussed. This is applied to the MeI *B* band system near λ 2000 and the two observed types of bands are explained. The pseudo-parallel bands are electronic-allowed perpendicular bands, their narrowness of structure resulting from an electronic angular momentum of 1 in the upper state. The weak widely-spaced bands are another type of perpendicular bands allowed by an interaction of the degenerate electronic state with a degenerate (*e*-type) vibration; they are $1 \leftarrow 0$ and $0 \leftarrow 1$ bands of such a vibration and of a second similar vibration. Their spacing is explained. Mol. consts. for the ground and excited electronic states are tabulated. The theory of the coupling of spin, orbital and angular momentum, and mol. vibration for various strengths of spin–orbit coupling is discussed. N. M. B.

Infra-red bands of hydrogen peroxide at λ 9720 and structure and torsional oscillation of hydrogen peroxide. L. R. Zumwalt and P. A. Giguère (*J. Chem. Physics*, 1941, **9**, 458—462).—Data are recorded for the fine structure of the OH bands of H_2O_2 at 9720 A. Rotational analysis of the hybrid bands 10283·68 cm.$^{-1}$ and 10291·08 cm.$^{-1}$ gives vals. $2{\cdot}78_6 \times 10^{-40}$ g. cm.^{2} for the smallest, and $33{\cdot}9 \times 10^{-40}$ g. cm.^{2} for the harmonic mean of the two largest, of the mol. moments of inertia. A non-planar configuration is indicated. L. J. J.

Infra-red absorption of silver cyanide. W. D. Stallcup and D. Williams (*J. Chem. Physics*, 1942, **10**, 199—200).—Powdered AgCN absorbs intensely at 2178 cm.$^{-1}$ (CN group), ~100 cm.$^{-1}$ > CN $\nu\nu$ of NaCN and KCN. W. R. A.

Spectra of chilled hydrocarbon flames. A. G. Gaydon (*Proc. Roy. Soc.*, 1942, **A**, **179**, 439—450).—The spectrum of the outer cone of hydrocarbon flames struck back in a water-cooled steel burner shows the ultra-violet bands usually known as the C_2H_4-flame bands. Under suitable conditions the bands are very strong. Chemical tests show that their occurrence is closely associated with the formation of a peroxide, probably an alkyl peroxide. The bands are not necessarily associated with the presence of aldehydes in the interconal gases. Various catalysts have little effect on the spectrum. The observations indicate the radical HCO as the emitter of the bands and a mechanism for its formation is suggested. G. D. P.

Heat of sublimation of carbon. G. Herzberg (*J. Chem. Physics*, 1942, **10**, 306—307).—Polemical against Kynch and Penney (A., 1942, I, 134). L. J. J.

Absorption spectra and constitution of acid anthraquinone dyes.—See A., 1942, II, 229.

Absorption of unsymmetrical cyanines. Resonance as a basis for a classification of dyes.—See A., 1942, II, 238.

Quenching and depolarisation of resonance radiation by collisions with molecules of a foreign gas. S. Mrozowski (*Physical Rev.*, 1942, [ii], **61**, 379—380).—A discussion of the results of Ellett *et al.* (cf. A., 1941, I, 398) and Olsen (cf. A., 1942, I, 126) with reference to Mitchell (cf. A., 1934, 936). N. M. B.

Fluorescence of phosphors in the rare gases. G. R. Fonda and H. Huthsteiner (*J. Opt. Soc. Amer.*, 1942, **32**, 156—160).—The excitation of fluorescence in a no. of phosphors in discharges through Ne, He, A, and Kr has been investigated. The behaviour of individual phosphors under these conditions is not correlated with their behaviour with other exciting λλ. Ca tungstate and Zn silicate phosphors are the most efficient in the rare-gas discharge. For Zn silicate the efficiency is increased by the removal of the free SiO_2 usually present, and, assuming that resonance radiation is the source of excitation, it is deduced that the quantum efficiency of fluorescence is ~1. The variation in intensity of fluorescence with the gas pressure is investigated. O. D. S.

Intramolecular energy transfer. Fluorescence of complexes of europium. S. I. Weissman (*J. Chem. Physics*, 1942, **10**, 214—217).—In certain org. derivatives of Eu the characteristic line fluorescence of Eu^{III} is excited by irradiation with light absorbed only by the org. part of the compound. The nature of the compound, temp., and solvent cause great variations in the efficiency of excitation; approx. unit efficiency is obtained with solutions of a covalent compound at liquid-air temp. The decay time of fluorescence is independent of quenching which prevents excitation of the Eu^{***} ion. There appears to be a steady gradation of efficiency of transfer from covalent to ionic compounds. W. R. A.

Polarisation of luminescence in crystals. B. V. Thosar (*J. Chem. Physics*, 1942, **10**, 246—247).—Using the technique of the polarisation of Raman lines, the state of polarisation of the sharp red luminescence doublet of ruby at 6936 A. and of three anti-Stokes bands of the doublet is investigated by measuring the ratio the intensities of luminescence parallel and perpendicular to *OZ*. The results are explained on a general interpretation of crystal luminescence which is being developed. W. R. A.

Quantitative Raman spectrum analysis.—See A., 1942, I, 247.

Raman line of cyanide ion. G. Glockler and H. T. Baker (*J. Chem. Physics*, 1942, **10**, 305—306).—Of the two lines 838 and 2080 cm.$^{-1}$ ascribed to CN^-, only the latter is genuine, with frequency $2086{\cdot}7 \pm 2{\cdot}7$ cm.$^{-1}$ The former is due to CNO^-. The force const. of CN^- is 1·65 megadynes per cm. L. J. J.

Raman spectra of monoalkylbenzenes and monoalkyl*cyclo*hexanes. J. Goubeau and E. Köhler (*Ber.*, 1942, **75**, [*B*], 65—72).—The lines 621, 1002, 1029, 1155, and 1604 cm.$^{-1}$ remain unchanged from PhMe to $C_{16}H_{33}Ph$ with a mean deviation of ±1 cm.$^{-1}$; the lines 1202, 1581, and 3057 cm.$^{-1}$ behave similarly but with somewhat greater deviation. These oscillations are therefore not influenced by the length of the side-chain. ω_4, however, depends markedly thereon although the influence does not extend beyond the third C. Changes in the lowest frequencies, γ, ω_{10}, and ω_1, are less obvious. As the length of the side-chain increases, the frequencies of the unbranched aliphatic chain become obvious. This increase is most marked with 1300 cm.$^{-1}$ and it may possibly be used to measure the length of the chain. The lines 444, 780, 842, 1032, 1079, 1161, 1261, 1347, and 1366 cm.$^{-1}$ appear in the spectra of all monoalkyl*cyclo*hexanes; there does not appear to be a frequency dependent on the length of the side-chain. H. W.

Photovoltaic effect. E. Adler (*J. Chem. Physics*, 1941, **9**, 486).—A reply to Cassel (A., 1941, I, 234). L. J. J.

Magnitude of solvent effect in dipole moment measurements. V. Solvent-effect constant and moments of alkyl iodides. A. Audsley and F. R. Goss (*J.C.S.*, 1942, 358—366).—Polarisation consts. of of 18 alkyl iodides, including higher members, in CCl_4 have been determined; results agree with the solvent effect equation (A., 1938, I, 136). The dipole moments are calc. from the coeffs. in this equation by the intercept ratio (A., 1941, I, 354, 358) and the additive nature of the at. polarisation (A., 1942, I, 91). The primary series exhibits an alternation of moments, even members having higher, and odd ones lower, moments. The moments and solvent effect consts. of *sec.* and *tert.* iodides also fall into regular series, the decrement in each case being 0·01 D. The solvent effect const. is defined, and its connexion with mol. structure is discussed; the Debye theory can be adapted to the liquid state even if the mols. are far from spherical. The equation and const. link the Lorenz field with the more correct Onsager field. Alkyl chains in the liquid phase appear to be curled; in the vapour state they are free to rotate. A. J. M.

Heavy water. P. W. Selwood (*J. Chem. Educ.*, 1941, **18**, 515—520).—A review. L. S. T.

Strength of carbon–hydrogen and carbon–carbon bonds. D. P. Stevenson (*J. Chem. Physics*, 1942, **10**, 291—294).—The bond strengths Me–H, Et–H, Me–Me, and Et–Et are calc. from (unpublished) electron impact crit. potential data as 101, 96, 82·6, and 77·6 kg.-cal. per mol. L. J. J.

Carbon–hydrogen bond strengths in methane and ethane. H. G. Andersen, G. B. Kistiakowsky, and E. R. van Artsdalen (*J. Chem. Physics*, 1942, **10**, 305).—The temp.-dependence of the rate of photochemical bromination of CH_4 gives 17·8 kg.-cal. for the activation energy of $Br + CH_4 = CH_3 + HBr$, leading to 102 ± 1 kg.-cal. for the C–H bond strength. The corresponding activation energy and bond strength in C_2H_6 are 13·8 and 98 ± 2 kg.-cal. L. J. J.

Calculation of steric hindrance. A. G. Evans and M. Polanyi (*Nature*, 1942, **149**, 608).—The steric effect of non-reacting groups on substitution rates is discussed with reference to the symmetrical substitution of $Bu^{\gamma}Cl$ by Cl ions. The distance between the centres of the obstructing H atoms and the centre of the Cl particle is calc. as 2·43 A., *i.e.*, 0·57 A. < the sum of the van der Waals radii of H and Cl. The corresponding energy of the compression involved in the reaction has been calc. and a model representing the transition state is described. A. A. E.

Diamagnetic anisotropy and the method of molecular orbitals. H. Brooks (*J. Chem. Physics*, 1941, **9**, 463—465).—Modification of the simple London theory for a non-orthogonality of 25% between wave-functions of adjacent atoms in org. mols. has little effect on calc. diamagnetic anisotropy, except for Ph_2. L. J. J.

Thermodynamic functions of paramagnetic substances and harmonic operators. J. R. Hull and R. A. Hull (*J. Chem. Physics*, 1941, **9**, 465—469).—Vals. are tabulated for partition function, magnetic moment, S/R, and $T(\partial S/\partial T)_H$ for free paramagnetic ions with j $\frac{1}{2}$, $\frac{3}{2}$, and $\frac{5}{2}$, in magnetic field H. Vals. for an Einstein oscillator are also calc. L. J. J.

Thermodynamic functions for molecules with internal rotation. K. S. Pitzer and W. D. Gwinn (*J. Chem. Physics*, 1941, **9**, 485—486).—Pitzer's formulæ and tables (A., 1937, I, 398) are accurate for all mols. having moments of inertia independent of the angle of internal rotation. An alternative derivation based on Crawford's analysis (A., 1940, I, 198) is outlined. L. J. J.

***X*-Ray study of liquid benzene, *cyclo*hexane, and their mixtures.** P. H. Bell and W. P. Davey (*J. Chem. Physics*, 1941, **9**, 441—450).—A Geiger–Müller counter was used with monochromatic Mo $K\alpha$ radiation. Pure C_6H_6 and *cyclo*hexane at 25° show new peaks at 4° 20′ and 4° 0′, broader and flatter than the sharp peaks at twice these angles. In mixtures the main peak has three sharp summits. The results are consistent with the cybotactic structure described. L. J. J.

Atomic distributions in liquid elements. C. Gamertsfelder (*J. Chem. Physics*, 1941, **9**, 450—457).—Mo $K\alpha$ patterns and Fourier analyses thereof are given for liquid Cl_2, Sn, In, Zn, Cd, Al, and Li. The at. distributions found are consistent with diat. Cl_2 in the liquid, and in good agreement with cryst. spacings for liquid Sn, Zn, and Al. L. J. J.

Interference at axially oriented polyatomic gas molecules. O. Steiner (*Naturwiss.*, 1942, **30**, 121—122).—The mathematical function governing the interference of *X*-rays or electrons at axially oriented polyat. gas mols. is given. Interference should occur at greater scattering angles than for non-oriented mols. A. J. M.

III.—CRYSTAL STRUCTURE.

Diffuse reflexion of *X*-rays by anisotropic and isotropic solids. H. A. Jahn and (Mrs.) K. Lonsdale (*Physical Rev.*, 1942, [ii], **61**, 375—376).—Experimental data for single crystals of Na, Li, Pb, KCl, and NaCl agree well with a formula previously found (cf. A., 1941, I, 195) for cubic lattices. A simplification of the formula for the case of isotropic solids is examined. N. M. B.

Temperature-diffuse scattering. M. Born (*Physical Rev.*, 1942, [ii], **61**, 377—378).—A discussion of Zachariasen (cf. A., 1942, **I**, 135), and a correction of his method of deriving the general intensity formula (cf. A., 1940, I, 285). N. M. B.

***X*-Ray microscope.**—See A., 1942, I, 249.

Indexing powder diffraction patterns of isomorphous substances. L. K. Frevel (*J. Appl. Physics*, 1942, **13**, 109—112). O. D. S.

Crystallographic structure of alkaline-earth oxide mixtures. Study of oxide cathodes by *X*-rays and electrons. H. Huber and S. Wagener (*Z. tech. Physik*, 1942, **23**, 1—12).—BaO–CaO, BaO–SrO, and SrO–CaO cathodes have been studied by the Debye–Scherrer method; the variation of the lattice consts. with mixture composition is examined. BaO– and CaO–SrO mixtures form mixed crystals, but BaO and CaO give microcryst. mixtures. The co-pptd. carbonate mixtures from which the cathodes are prepared form mixed crystals throughout. Electron-diffraction experiments by the Seemann method show that each cathode surface is covered with a layer (300—2000 atoms thick) of the less volatile component of the mixture. The results are discussed in relation to the emissive properties of the cathodes. A. J. E. W.

Crystal structure of some strontium–bismuth oxyhalides. ($SrBi_3O_4Cl_3$, $SrBiO_2Br$, $SrBi_2O_3Br_2$, and $SrBi_3O_4Br_3$). L. G. Sillén (*Z. anorg. Chem.*, 1941, **246**, 115—130).—By heating $SrCl_2$ with BiOCl and Bi_2O_3, the *compound* $SrBi_3O_4Cl_3$ has been obtained. When $SrBr_2$ is heated with appropriate mixtures of BiOBr, Bi_2O_3, and SrO the *compounds* $SrBi_3O_4Br_3$, $SrBi_2O_3Br_2$, and $SrBiO_2Br$ are produced. *X*-Ray investigations show that these comprise metal and O atoms in planes alternating with the planes containing halogen atoms. All are tetragonal with $a \sim 3{\cdot}9$ A. The charge distribution is discussed in relation to Pauling's rule (A., 1929, 748). J. W. S.

Crystal structure of some cadmium–bismuth oxychlorides and oxybromides. L. G. Sillén (*Z. anorg. Chem.*, 1941, **246**, 331—346).—Cryst. phases of analogous structure to those described earlier for a no. of oxyhalides (cf. A., 1939, I, 457) are isolated from the system BiOCl, Bi_2O_3, CdO, excess $CdCl_2$, and the corresponding oxybromide system. The structure of these phases, determined by *X*-ray methods, is found to be of three types: X_3, with triple halogen layers between the metal–oxygen layer, X_2X_3 with alternating double and triple halogen layers, and $X_2X_2X_3$ in which two double layers are followed by a triple layer. The formulæ of the phases of these types are respectively X_3, $Cd_{2-3x}Bi_{1+2x}O_2Hal_3$ ($x = 0{\cdot}2$—$0{\cdot}3$); X_2X_3, $Cd_{2-3x}Bi_{3+2x}O_4Hal_5$; and $X_2X_2X_3$ $Cd_{2-3x}Bi_{5+2x}O_6Hal_7$. The compound $CdBiO_2Br$ exists in two cryst. forms with differing cell dimensions. O. D. S.

Structure and thermal properties associated with some hydrogen bonds in crystals. IV. Isotope effects in some acid phosphates. A. R. Ubbelohde and I. Woodward (*Proc. Roy. Soc.*, 1942, **A**, **179**, 399—407; cf. A., 1940, I, 151).—The expansion of the lattice of $NH_4H_2PO_4$ due to the substitution of D for H is measured. It takes place in the direction of the H bonds and is of the same magnitude as in the isomorphous KH_2PO_4. A contraction in the plane at right angles to the H bonds is considerably larger in the NH_4 salt. Attention is called to the presence of diffuse reflexions in photographs of the monoclinic form of KD_2PO_4. Attempts to obtain $NH_4D_2PO_4$ and KH_2PO_4 in the monoclinic form were not successful. G. D. P.

Structure of polychloroprene. C. J. B. Clews (*Proc. Roy. Soc.*, 1942, **A**, **180**, 100—107)—Polychloroprene, examined by *X*-rays before and after light-treatment, shows no change of crystal. The unit cell is possibly orthorhombic with a 8·90, b 4·70, c 12·21 A., containing four C_4H_5Cl units. G. D. P.

Molecular structure and rubber-like elasticity. I. Crystal structure of β gutta-percha, rubber, and polychloroprene. II. Stereochemistry of chain polymers. III. Molecular movements in rubber-like polymers. C. W. Bunn (*Proc. Roy. Soc.*, 1942, **A**, **180**, 40—66, 67—81, 82—99).—I. The structures are as follows: β-gutta-percha (**I**), orthorhombic, a 7·78, b 11·78, c 4·72 A.; rubber (**II**), monoclinic, a 12·46, b 8·89, c 8·10 A., β 92°; polychloroprene (**III**), orthorhombic, a 8·84, b 10·24, c 4·79 A. In all cases four long-chain mols. pass through the unit cell parallel to the c axis. The co-ordinates of the C atoms are given; there is a close analogy between the structures of (**I**) and (**III**). In all three cases the mols. are asymmetric and have non-planar zigzag chain forms.

II. A survey of the structure of mols. containing two or more singly linked C atoms favours the "staggered bond" configuration, in which the bonds issuing from a pair of neighbouring C atoms do not fall over one another in plan but form a six-rayed star, the bonds *abc* belonging to one C atom, *a′b′c′* to the other. If *d* denotes the bond between the two C atoms, sequences *a′da*, *a′db*, and *a′dc* are possible. Repetition of the first gives a simple zigzag chain of the normal long-chain paraffin type. Repetition of the other two leads to right- and left-handed spirals of C atoms. Mols. with N, O, and S atoms seem to conform to the "staggered-bond" principle. The non-planar chain forms of (**I**), (**II**), and (**III**) are attributed to the co-operation of the principle of staggered bonds and the repulsion between Me or Cl side substituents and particular CH_2 groups in the chains.

III. In (**I**) and (**III**) changes in mol. configuration due to rotation around the single bonds occur at the "m.p." The relatively low "m.p." compared with polyethylene is ascribed to greater freedom of this rotation. The differences between the mechanical properties and "m.p." of (**I**) and those of (**II**) receive a qual. explanation. G. D. P.

Electron diffraction studies on thin films. III. Powder patterns containing anomalies produced by secondary scattering. L. H. Germer (*Physical Rev.*, 1942, [ii], **61**, 309—312; cf. A., 1942, I, 47).—Owing to tolerance in glancing angle in the production of diffracted electron beams, each first-order beam can again be diffracted by the same set of planes to give an apparent second-order beam. In patterns from polycryst. substances this results in strengthening of all second-order diffraction rings. The effect is appreciable only with large individual crystals, and can be observed only when a true second-order ring is very weak. The effect is observed in patterns from CuCl, CuBr, and CaF_2. N. M. B.

Magnetisation near boundaries. J. H. Wakelin, jun. (*J. Appl. Physics*, 1942, **13**, 227—235).—Magnetic measurements on rings of Fe–Si, commercially pure Ni, and low-C steel indicate a dependence of magnetic properties on thickness, due to variation of the sp. surface. A. J. M.

Photodichroism of coloured sodium chloride. S. Nikitine (*Compt. rend.*, 1941, **213**, 32—34).—Crystals of NaCl coloured by irradiation with β- and γ-rays from Ra show photodichroism when exposed to the light from a high-pressure Hg lamp. The relative dichroism is not great. An explanation is suggested. A. J. M.

Frequency spectrum of crystalline solids. E. W. Montrole (*J. Chem. Physics*, 1942, **10**, 218—229).—Mathematical. W. R. A.

Validity of the Langevin theory of orientation and the possibility of distinguishing between inherent and photo-elastic anisotropy. W. Heller and (Miss) G. Quimfe (*Physical Rev.*, 1942, [ii], **61**, 382).—Proof of the explanation of the linear magneto-optical anisotropy of homogeneous and dispersed systems as a result of orientation of anisotropic elements (mols. or crystals) may be based on the concept that orientation alone should not change the optical properties of the individual elements. This is supported by experiments with a special optical arrangement giving direct vals. of absorption coeffs. parallel and perpendicular to the magnetic field. Results on an Fe oxide sol at fields >10,000 gauss accord closely with Langevin's relation. Hydrodynamical orientation and photo-elasticity or anisotropies not due to orientation alone are discussed. N. M. B.

Elasticity and creep of lead single crystals. I. H. Swift and E. P. T. Tyndall (*Physical Rev.*, 1942, [ii], **61**, 359—364).—The rigidity and Young's moduli of Pb single crystals are measured statically as functions of crystal orientation, and the elastic parameters obtained agree with vals. found dynamically (cf. Goens, A., 1936, 785). The influence of bending-torsion effect on the measurement of rigidity modulus by torsion is studied. The elastic limit for Pb under longitudinal stress occurs when the resolved shear stress on the most favourably placed octahedral plane is $\sim 2 \times 10^6$ dynes per sq. cm. Observations of transient creep under longitudinal stress show that creep strain velocity at any instant is $\propto$ difference between final strain under that load and strain at the instant. N. M. B.

Stress–strain curve for the atomic lattice of mild steel, and the physical significance of the yield point of a metal. S. L. Smith and W. A. Wood (*Proc. Roy. Soc.*, 1942, **A**, **179**, 450—460).—*X*-Ray measurements are made of the lateral contraction which accompanies the extension of a test-piece. Up to the yield point the lattice contraction $\propto$ the applied stress in conformity with Hooke's law; beyond the yield point the spacing undergoes a sudden expansion, which is retained when the load is removed. The permanent expansion imposed on the lattice increases in magnitude up to the ultimate stress, and the intensity of *X*-ray diffraction diminishes by ~50% when yield occurs. G. D. P.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Magnetochemical investigations. XXXVIII. Magnetic behaviour of some compounds of transition elements. H. Bommer (*Z. anorg. Chem.*, 1941, **246**, 275—283).—$Co_2(SO_4)_3,18H_2O$ and $RbCo(SO_4)_2,12H_2O$ are diamagnetic or weakly paramagnetic, and therefore contain penetration complexes (probably $[Co(H_2O)_6]^{'''}$). At. linkings probably occur in all Co^{III} compounds, the $Co^{II} \rightarrow Co^{III}$ transition occurring only when the formation of at. linkings liberates energy. $CsMn^{III}(SO_4)_2,12H_2O$ obeys the Curie law accurately (moment 4·91 Bohr magnetons), and thus contains a normal complex. $CsRh(SO_4)_2,12H_2O$ is diamagnetic and contains a penetration complex. A. J. E. W.

Magneto-chemical investigations. XXXIX. Ionic diamagnetism. II. W. Klemm (*Z. anorg. Chem.*, 1941, **246**, 347—362).—The data in the literature for the diamagnetism of ions are critically discussed and correlated. O. D. S.

Anisotropy of ferromagnetic powder particles. E. T. Benedikt (*J. Appl. Physics*, 1942, **13**, 105—109).—The magnetic moments of films of Fe, Fe_2O_3, and Fe_3O_4 deposited by sedimentation in a magnetic field were measured. The particles are anisotropic. O. D. S.

Supersonic dispersion in gases. Vibrational activation of the acetaldehyde molecule. E. A. Alexander and J. D. Lambert (*Proc. Roy. Soc.*, 1942, **A**, **179**, 499—511).—Supersonic dispersion in MeCHO vapour is investigated in piezoelectric, magnetostrictive, and Kundt's-tube interferometers over a wide range of frequency and pressure. A region of multiple dispersion is found implying the activation of intramol. vibrations. G. D. P.

Properties of Bose–Einstein gases. L. Goldstein (*J. Chem. Physics*, 1941, **9**, 472—479).—Relations between Bose–Einstein condensation and heat capacity are discussed. L. J. J.

Statistical thermodynamics of several halomethanes. W. F. Edgell and G. Glockler (*J. Chem. Physics*, 1941, **9**, 484—485).—Vals. of C_p for MeF, MeI, and CH_2Br_2 at 298·1—600° K., calc. to the rigid rotator simple harmonic oscillator approximation, are recorded. L. J. J.

Second virial coefficients and the forces between complex molecules. J. O. Hirschfelder, F. T. McClure, and I. F. Weeks (*J. Chem. Physics*, 1941, **10**, 201—211).—The second virial coeffs. of C_2H_6, C_3H_8, n-C_4H_{10}, n-C_7H_{16}, NH_3, MeCl, some olefines, and the "freons" have been computed from experimental data. At $>T_c$ the second virial agrees with the theorem of corresponding states, but at $<T_c$ dipole mols. have very large virials. Isomeric hydrocarbons give virials which are not sensitive to the shape of the mol. and hence an exact determination of intermol. interaction from the temp. variation of the second virial. Imperfections of a gas arise from the presence of double mols. which exist for the duration of a collision. The equilibrium const. for the formation of double mols. is related to the second virial and its temp. variation gives ΔS and ΔE of their formation, both of which are qualitatively interpretable in terms of intermol. forces. A corresponding-states equation is given for estimating second virials when no experimental data are available. W. R. A.

Thermodynamic properties of air. R. V. Gerhart, F. C. Brunner, H. S. Mickley, B. H. Sage, and W. N. Lacey (*Mech. Eng.*, 1942, **64**, 270—272).—At high pressures air deviates significantly from perfect gas behaviour. Its thermodynamic properties have been computed from available data at pressures up to 3500 lb. per sq. in. for the range 0—288°. R. B. C.

Mechanism for self-diffusion in metallic copper. H. B. Huntington and F. Seitz (*Physical Rev.*, 1942, [ii], **61**, 315—325).—Three mechanisms, direct interchange of atoms, interstitial diffusion, and vacancy diffusion, are discussed on the basis of the modern theory of metals. Results strongly favour the vacancy mechanism and yield a val. of the activation energy for diffusion in fair agreement with observation (cf. following abstract). N. M. B.

Self-consistent treatment of the vacancy mechanism for metallic diffusion. H. B. Huntington (*Physical Rev.*, 1942, [ii], **61**, 325—338; cf. preceding abstract).—A self-consistent solution to the Hartree–Fock equation is used with a free-electron model corresponding with the Cu lattice for a more detailed calculation of the energy needed to form a vacancy. The result agrees essentially with the predicted val. (cf. *ibid.*), and a rough upper limit is found for the energy required to move a vacancy. This val. compares satisfactorily with the observed energy of activation for Cu self-diffusion. The observed anisotropy in Zn self-diffusion (cf. Banks, A., 1941, I, 201) is qualitatively explained on the vacancy process. Data for the alkali metals are insufficient. N. M. B.

Elementary theory of thermal diffusion. R. Fürth (*Proc. Roy. Soc.*, 1942, **A**, **179**, 461—469).—An approx. theory is developed which reveals the physical mechanism of the phenomenon. It leads to a formula for the diffusion ratio which accounts for many of the characteristic properties of thermal diffusion. G. D. P.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Kinetic theory of diffusion forces in metabolising systems. H. D. Landahl (*Bull. Math. Biophysics*, 1942, **4**, 15—26).—An expression has been derived for the force on a particle in a non-uniform mixture of gases, and an attempt has been made to extrapolate the results to liquids by considering liquids as limiting cases of very dense gases. A similar expression for the force on a particle obtained on hydrodynamic grounds leads to results of the same order of magnitude. Diffusion drag forces on a diffusing solute depend chiefly on the physical properties of the solvent. C. R. H.

Statistical mechanics of many-component gases. K. Fuchs (*Proc. Roy. Soc.*, 1942, **A**, **179**, 408—432).—J. E. Mayer's theory of condensing systems is generalised for a mixture of an arbitrary no. of gases. Equations for chemical equilibrium are derived, which at low pressures reduce to the law of mass action. G. D. P.

Construction of a theory of solutions. M. Bodenstein, K. F. Bonhoeffer, and G. Joos (*Z. physikal. Chem.*, 1940, **B**, **47**, 288—290).—Criticisms of papers by Fredenhagen (A., 1938, I, 399) and Fredenhagen and Tramitz (A., 1942, I, 16). A. J. M.

Theory of solutions. IV. K. Fredenhagen and E. Tramitz (*Z. physikal. Chem.*, 1940, **B**, **47**, 291—314).—The basis of the van 't Hoff excess pressure theory is discussed, with particular reference to the criticisms of Bodenstein *et al.* (see preceding abstract). The differences between the excess pressure and the pressure defect theories are discussed. A. J. M.

Determination of mol. and ionic wts. of solutes by dialysis and free diffusion. H. Brintzinger (*Z. physikal. Chem.*, 1940, **A**, **187**, 317—334).—Reply to criticism by Jander *et al.* (*ibid.*, 13). W. R. A.

Diffusion coefficient of cupric sulphate from 0·0 to 0·35 molar at 25°. W. G. Eversole, H. M. Kindsvater, and J. D. Peterson (*J. Physical Chem.*, 1942, **46**, 370—375).—With increase in concn. (C) the decrease in diffusion coeff., which is continuous throughout the range studied, is linear with $C^{0·5}$ up to 0·0125M. C. R. H.

Rate of nucleation of silver chromate in supersaturated solutions. A. Van Hook and J. C. Ahlborn (*J. Physical Chem.*, 1942, **46**, 395—399).—An implied equation that the rate of Ag_2CrO_4 nucleation is linear in terms of supersaturation (cf. A., 1940, I, 364; 1942, I, 68) has been experimentally confirmed. C. R. H.

Radioactive investigations with solutions and powders. C. Lieseberg (*Z. physikal. Chem.*, 1940, **B**, **47**, 269—287).—The effect of the addition of sulphates and carbonates to solutions containing $Ra^{''}$ has been investigated. The effect depends on whether $RaSO_4$ or $RaCO_3$ is capable of forming mixed crystals with the added substance. If this is the case there is a considerable decrease in the

radiation from the solution when the SO_4'' or CO_3'' are added. The effect is greater if Ba'' are present. The addition of Ca'', especially in the presence of SO_4'', does not cause a decrease in the radiation. The absorption of radiation by powders, especially ZnS, was also investigated. The method is of use for the detection of differences in structure of substances, where these differences are shown at the surface. Experiments with ZnS show that the addition of heavy metals in the formation of ZnS phosphors causes stuctural changes in the ZnS, since the absorption of radiation is less in the phosphor than in ZnS alone. A. J. M.

Relative viscosity of non-aqueous solutions. H. T. Briscoe and W. T. Rinehart (*J. Physical Chem.*, 1942, **46**, 387—394).—Relative η (η_0) data for solutions of $C_{10}H_8$ in C_6H_6 and in MeOH, of Ph_2 in C_6H_6, and of KI in MeOH and in glycerol (I) are recorded. η_0 for KI–(I) solutions increases and for the other solutions decreases with increasing temp. The plot of $(\eta_0 - 1)/C$ against C (C = concn.) passes through a min. in the case of the KI solutions, the effect being more pronounced at high than at low temp. for MeOH solutions and more pronounced at low than at high temp. for (I) solutions. C. R. H.

Diffraction of *X*-rays by liquid benzene–*cyclo*hexane mixtures. A. Eisenstein and N. S. Gingrich (*J. Chem. Physics*, 1942, **10**, 195—199).—By both the photographic and the Geiger–Müller tube methods the fine structure on the main peak and the secondary peak reported by Bell and Davey (*ibid.*, 1941, **9**, 441) could not be obtained. W. R. A.

Volatility, vapour pressures, and diffusion coefficients in the system Novolac–acetophenone. E. Jenckel and J. Komor (*Z. physikal. Chem.*, 1940, **A**, **187**, 335—353).—Mixtures of COPhMe (I) and a Novolac resin were confined in a small container, the lid of which had a small aperture of known diameter through which (I) slowly diffused. The loss in wt. per unit time $\propto$ v.p. for mixtures rich in (I). Volatility is related to v.p. at >70% (I) and to diffusion coeff. at <60% (I). A partial differential equation has been developed connecting these quantities in good agreement with experimental vals. W. R. A.

Analysis of the ternary system ethyl alcohol–methyl alcohol–water. J. Griswold and J. A. Dinwiddie (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 299—300).—In the method described, b.p., n, and ρ are determined, and composition is then read from a chart. L. S. T.

Thermal analyses with a hot-stage microscope. II. Contact zones. A. Kofler (*Z. physikal. Chem.*, 1940, **A**, **187**, 363—373).—The following systems have been examined microscopically at different temp. and eutectics and mol. compounds, with their thermal characteristics, are reported: NHPhAc–Ph_2; 1 : 2 : 4-$C_6H_3Me(NO_2)_2$–$C_{10}H_8$; phenanthrene–2 : 4-dinitrophenol; *s*-$C_6H_3(NO_2)_3$–β-$C_{10}H_7 \cdot NH_2$; antipyrine–quinol; picric acid–*s*-$C_6H_3(NO_2)_3$. W. R. A.

Irregular distribution of dissolved oxygen in copper, detected by electrolytic polishing. C. Benedicks and B. Ljunggren (*Korros. u. Metallschutz*, 1940, **16**, 17—21).—"Electrolytic polishing" of Cu which has oxide inclusions leads to irregularities of the surface in the regions of high O content. The normal irregularities due to abrasion and etching are relatively easily removed by the process. The significance of the O-inclusions in the normal corrosion of Cu is discussed. J. W. S.

Lattice spacings of the primary solid solutions in magnesium of the metals of group IIIB and of tin and lead. G. V. Raynor (*Proc. Roy. Soc.*, 1942, **A**, **180**, 107—121).—Accurate measurement of the lattice spacings of the solid solutions of Al, Ga, Tl, Sn, and Pb in Mg confirm that the effect of increasing the valency of the solute atom is to tend to expand the lattice of Mg. The *c*-spacing–composition curve shows a change in direction at the point where an overlap of electrons from the first Brillouin zone occurs. Beyond this point the variation of axial ratio with composition $\propto$ the electron concn. The results confirm that In, Tl, white Sn, and Pb are incompletely ionised in the elementary state. G. D. P.

Solubility of sodium palmitate in organic liquids. C. W. Leggett, jun., R. D. Vold, and J. W. McBain (*J. Physical Chem.*, 1942, **46**, 429—440).—Previous data (cf. A., 1941, I, 83) have been extended to 11 additional solvents. The relation of solubility to the size, shape, and polar nature of the solvent mols. is discussed. C. R. H.

Sorption of water vapour by vermiculite and its silica. Equilibrium measurements. L. A. Spitze and L. A. Hansen (*Ind. Eng. Chem.*, 1942, **34**, 506—508).—Isotherms for the sorption of H_2O vapour by vermiculite (I), exfoliated vermiculite (II), and the activated SiO_2 derived from each have been determined at 25°, 45°, and 65°. Hysteresis was shown by both SiO_2, but not by (I) or (II). M. H. M. A.

Influence of temperature changes on efficiency of activated carbon. —See B., 1942, I, 290.

Thermal effects produced during adsorption of acetone by nitrocelluloses. E. Calvet (*Compt. rend.*, 1941, **213**, 126—128).—The heat evolved on adsorption of $COMe_2$ by nitrocellulose (I) containing 14% N is $\propto$ wt. of $COMe_2$ adsorbed, and amounts to 3900 g.-cal. per g.-mol. of $COMe_2$ adsorbed. The same proportionality is observed for the adsorption of $COMe_2$ on (I) containing 11·47% N up to the adsorption of ~3 mols. of $COMe_2$ to each C_6 chain. Gelatinisation, which commences when 1 mol. of $COMe_2$ has been adsorbed to each C_6 chain, does not affect the heat evolved, nor does the point corresponding with the fixation of 1 mol. of $COMe_2$ per NO_2. With the adsorption of >3 mols. of $COMe_2$ per C_6 there is a slight decrease in the amount of heat evolved, but at the adsorption of 6 mols. of $COMe_2$ there is a sudden decrease, corresponding with the formation of a complex hexa-acetonate of (I). There is a max. in the heat evolved when the wt. of $COMe_2$ adsorbed is approx. twice the wt. of the (I). This amounts to 88·4 g.-cal. per g. of (I). It is ~5 times the heat of dissolution of (I) (17·5 g.-cal. per g.). A. J. M.

Surface tension of micelle-forming solutions. H. M. Cassel (*J. Chem. Physics*, 1942, **10**, 246).—The min. val. of γ for soaps and other long-chain mols. in H_2O at <0·01M. is considered in the light of different theories. W. R. A.

Interfacial tension of solutions with respect to mercury. H. Dunken (*Z. physikal. Chem.*, 1940, **B**, **47**, 195—219).—The accuracy of the drop wt. method of determining surface tension is discussed, and the method is used to determine the interfacial tension of org. liquids, and mixtures of them, against Hg. At the interface between Hg and a mixture of a polar and a non-polar liquid, the non-polar liquid may be adsorbed. There are connexions between the nature of the polar groups, the positions of the atoms of the polar groups in the periodic system, and the chain length of the mol. on the one hand, and the interfacial tension of the pure substances with respect to Hg and their surface activity in the mixtures on the other. The connexion between interfacial tension and η is discussed. A. J. M.

Nomograph for the angles of liquid lenses. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 442—443; cf. A., 1941, I, 374).—Nomograph for obtaining α, the single segment angle of a liquid lens, from the equation: $\sin\alpha(2 + \cos\alpha)/(1 + \cos\alpha)^2 = 24v\alpha/\pi d^3$, where v and d are the mass and diameter of one segment respectively. M. H. M. A.

Amonton's law, "traces" of frictional contact, and experiments on adhesion. R. Schnurmann (*J. Appl. Physics*, 1942, **13**, 235—245).—The mechanical cleanliness of the surface of a solid in air, and the effect of adsorbed matter on the coeff. of friction, μ, are discussed. Amonton's law ($F = \mu N$) breaks down when the thickness of the adsorbed film is ~1 mol., and when the actual area of contact is a considerable fraction of the nominal area of contact. "Traces" of sliding were obtained by "developing" a glass surface, on which a metal had been sliding or rolling, with $AgNO_3$ and a reducing agent. The microscopic differences between the traces obtained for sliding and rolling are described and discussed. The traces measure the torn proportion of the area of contact. Very thin films of adsorbed matter between the high points of two solids in contact act as powerful adhesives. The jerky motion of Hg in glass capillaries is considered as a frictional phenomenon. Adhesion due to the porosity of one of the surfaces in contact is also dealt with. A. J. M.

Monolayers of compounds with branched hydrocarbon chains. V. Phthiocerol. S. Ställberg and E. Stenhagen (*J. Biol. Chem.*, 1942, **143**, 171—176).—Phthiocerol [probably $C_{34}H_{67}(OH)_2 \cdot OMe$] forms a typical liquid-expanded monolayer on a 0·01N-HCl substrate. Its temp. of half expansion is 17° and the min. mol. area to which the monolayers can be compressed before collapse is 30—31 A.^{2} At 5° the layer is solid condensed. At 20° the apparent surface moment is 880 MD. at 122 A.^{2} but is decreased on compression to ~450 MD. at 31 A.^{2} area. Perfect multilayers could not be built and *X*-ray measurements on an imperfect 25-layer multilayer built up in Z-form indicated that this was poorly cryst. The behaviour observed is interpreted as indicating that the mol. is long with only short side-chains and with one or more polar groups near one end. J. W. S.

Proposed general structure for condensed unimolecular films. A. E. Alexander (*Proc. Roy. Soc.*, 1942, **A**, **179**, 486—499).—A brief review of existing theories of condensed monolayers is given. Experimental evidence indicates that in the least compressible region the long chains of hydrocarbons are vertically oriented and close-packed, but not so tightly packed as in the solid crystal. Between this region and the expanded state (determined only by head group dipole orientation) there is a more compressible region. The configuration at the limiting area is determined both by the orientation of the head group dipole and by the long chain packing. Known classes of condensed monolayers are grouped according to the factors thought to be responsible for determining the limiting area, viz., size of head group, H bond formation between head groups, and hydrocarbon chain packing. G. D. P.

Rôle of hydrogen bonds in condensed monolayers. A. E. Alexander (*Proc. Roy. Soc.*, 1942, **A**, **179**, 470—485).—From the behaviour of monolayers of compounds containing the –CO·NH– linking it is concluded that intermol. H bonding can play a major part in de-

termining the properties of condensed monolayers. With substituted acetamides and carbamides the H bonding is sensitive to the p_H of the substrate, very acid substrates leading to complete liquefaction, in contrast with the behaviour of the analogous acetates where no intermol. H bonding is possible. Calc. H bond distances agree with those in the crystal with the same head group. The free energy difference between the –CO·NH– group when forming H bonds to H_2O (as in the expanded film) and when cross-linked (as in the low-temp. form) is calc. to be ~840 g.-cal. per g.-mol. The importance of such measurements in determining the part played by the H bond in protein mols. is pointed out. G. D. P.

Interaction between adsorbed substances of simple constitution and insoluble monolayers. II. K. G. A. Pankhurst (*Proc. Roy. Soc.*, 1942, **A**, **179**, 393—399; cf. A., 1939, I, 367).—Penetration of monolayers of aliphatic substances and sterols by aliphatic alcohols and acids with 5—8 C is similar to that by the C_4 alcohol and acid but is much more powerful. Penetration by C_6H_4Et·OH is ≫ by PhOH. Each CH_2 added to the hydrocarbon chain decreases the concn. required for equal penetration by a factor of ~4·5. The penetration is non-sp. and only destroys the cohesion of the monolayer. A sensitive single wire surface balance is described. G. D. P.

Highly purified colloids. (From electrodialysis to electrodecantation.) W. Pauli (*Helv. Chim. Acta*, 1942, **25**, 137—161).—A review. F. J. G.

Gold sol. I. Instability in gold sols. H. R. Kruyt and J. G. Vogel (*Kolloid-Beih.*, 1940, **52**, 87—164).—Automatic apparatus for the dispersion of Au by Bredig's method is described. An equilibrium concn. of ~0·3% Au is reached, but further concn. up to ~1·5% Au can be effected by electrodecantation, ultrafiltration, etc. The more conc. sols are unstable, and their instability increases with progressive removal of the HCl used as the dispersion medium. Sols prepared by dispersion in very pure H_2O are completely unstable. HCl-dispersed sols, of whatever concn., undergo a coarsening, which *X*-ray examination shows to be due to aggregation of the original particles. The coarsened sols are, or can be made, stable, and behave normally towards electrolytes. Coarsening is produced by Cl′, Br′, and by complex ions containing them only in an acid medium, whereas the coarsening due to I′ is independent of the medium. The causes of the phenomenon are discussed, and an explanation based on the preferential discharge of stabilising ions at certain positions on the particles is put forward. F. L. U.

Structure and capacity of electrical double layer. J. J. Bikerman (*Phil. Mag.*, 1942, [vii], **33**, 384—397).—In an inhomogeneous field substances of high dielectric const. accumulate where field intensity is max. This property determines the distribution of ions and solvent mols. competing for positions near an interface. For Hg–solution interfaces the theory accounts for the shape of capacity–potential curves, and confirms Gouy's vals. for low potentials and concns. At high potentials the thickness of the equiv. double layer is equal to the distance between the charges in the resultant dipole. L. J. J.

Diffusion as a function of aggregation in colloidal media. H. Branson (*Bull. Math. Biophysics*, 1942, **4**, 1—6).—Assuming that adsorption is a simple function of surface area, a simple diffusion equation has been deduced from a mathematical consideration of the dependence of the diffusion coeff. of an adsorbable solute on the degree of aggregation of the adsorbing colloid. C. R. H.

Variations in the electrochemical properties of hydrogen-clay sols with temperature. B. Chatterjee and A. Sen (*J. Indian Chem. Soc.*, 1941, **18**, 646—647).—Unlike SiO_2 sols and H-bentonite sols (Mukherjee *et al.*, A., 1942, I, 57), H-clay sols show an increase in degree of dissociation between 1° and 50°. F. R. G.

Electrochemical properties of silicic acid sols. III. Variations in the p_H, specific conductivity, and total acidity of silicic acid sols with dilution and with temperature. B. Chatterjee and A. Sen (*J. Indian Chem. Soc.*, 1942, **19**, 17—24).—The free and total acidities of silicic acid sols change linearly with concn. but are const. from 1° to 50°. Their degree of dissociation is independent of concn. and temp. (1—50°). The sp. conductivity increases linearly with temp., coeff. 2% at 18°. D. F. R.

Viscosity of "ferric oxide" hydrosols. L. M. Greenstein and A. W. Thomas (*J. Chem. Physics*, 1942, **10**, 229—240).—Changes in η of "ferric oxide" hydrosols on ageing, heating, addition of electrolytes and non-electrolytes, and the corresponding changes in p_H and sp. conductances (κ) have been investigated. Poiseuille's law holds for cationic and anionic hydrosols. η decreases and κ increases with ageing and with heating. Addition of salts and acids causes a primary decrease in η followed by an increase at higher concns. which occurs at salt or acid concns. which are the lower, the greater is the pptg. power of the salt or acid. η of cationic hydrosols is decreased more by salts than by acids. Explanations are advanced. W. R. A.

Relation between viscosity of solutions and physical properties of high polymerides. R. Simha (*J. Appl. Physics*, 1942, **13**, 147—153).—A review and discussion of the effect of mol. shape on η in solutions of high polymerides. The correlation of η and sedimentation data, the relation between mol. wt., shape, and internal friction, and the effects of mol. orientation and flexibility are discussed. A. J. E. W.

Frictional phenomena. VIII. A. Gemant (*J. Appl. Physics*, 1942, **13**, 210—221).—The η of colloidal systems varies with stress owing to gel formation. In such systems the rate of shear does not vary linearly with stress for stationary flow, and there is a finite relaxation process for suddenly applied stresses or deformations. For vibrational processes, the dynamic η is dependent on frequency. The chief experimental facts bearing on these points are reviewed. A. J. M.

Relaxation effects in amorphous media. R. Simha (*J. Appl. Physics*, 1942, **13**, 201—207).—The Maxwell relaxation theory is developed and extended to systems composed of several viscous-elastic components with different relaxation times, or of high-polymeric materials having a continuous relaxation rate distribution. A. J. E. W.

Orientation of micelles in soap fibres. S. Ross (*J. Physical Chem.*, 1942, **46**, 414—417).—Discussion. C. R. H.

Swelling pressure and sorption hysteresis in gels.—See B., 1942, I, 305.

Heat of coagulation of silica and its bearing on the structure of silica gels. A. R. Tourky (*Chem. and Ind.*, 1942, 254—255).—The heat of coagulation of SiO_2 gel under the influence of HCl varies from ~148 g.-cal. per g. of SiO_2 where the amount of HCl is just sufficient to make the solution neutral to ~336 g.-cal. per g. of SiO_2 where the final p_H is 2—3. The data are discussed with reference to those of other workers and to the general theory of gel structure. C. R. H.

Electrophoresis of the chlorophyll–protein complex.—See A., 1942, III, 554.

Migration of colloids through the interface between immiscible liquids under the influence of an electric field, and the formation of ultra-colloids. G. E. Gibson and L. Baldwin (*J. Chem. Physics*, 1942, **10**, 247—248).—In the two-phase system H_2O–$COMe_2$–Et_2O in a U-tube with electrodes dipping in the Et_2O-rich phases, colloidal As_2O_3, Au, C, and bentonite clay traverse the interface on applying an e.m.f. (~200 v. for As_2S_3 if Et_2O only slightly in excess; otherwise >200 v.). Viewed through the ultra-microscope the colloid particles perform violent motions soon after the e.m.f. is applied. After some time a dark band, presumably the region of high potential gradient, develops in the Et_2O-rich layer and in it is formed an extremely fine colloid. The violence of the motions of colloid particles is diminished by careful dialysis to remove electrolytes. W. R. A.

VI.—KINETIC THEORY. THERMODYNAMICS.

Pressure dependence of the equilibrium constant of ammonia. K. Fuchs (*Proc. Roy. Soc.*, 1942, **A**, **179**, 433—438).—A theoretical investigation of the chemical equilibrium of a slightly imperfect gas is made. At high temp. the consts. in the formula can be expressed in terms of the van der Waals consts. Numerical results for NH_3 are in good agreement with experiment. G. D. P.

Dielectric polarisation and association of alicyclic alcohols. W. Hückel and I. Schneider (*Z. physikal. Chem.*, 1940, **B**, **47**, 227—244).—The variation of the orientation polarisation with concn. is studied for *sec.* alicyclic alcohols dissolved in C_6H_6 and in *cyclo*hexane. For alcohols with considerable steric hindrance (*e.g.*, α-fenchol, *trans*-β-decalol) orientation polarisation falls steadily with concn. For low concns. the association determined by the cryoscopic method and the orientation polarisation vary together if the association is to double mols. with no moment. For alcohols showing no steric hindrance the variation of orientation polarisation with concn. is quite different, and can be explained only on the assumption of a chain association to double mols. and quadrupole double mols. at low concns. A. J. M.

Complex formation in aqueous mercuric chloride and potassium iodide by conductivity, viscosity, and refractivity measurements. D. N. Solanki and B. G. Joshi (*J. Indian Chem. Soc.*, 1942, **19**, 9—16).—The occurrence of max. or min. in sp. conductivity–, *n*–, and η–composition curves suggests the existence of $10KI,HgCl_2$, $20KI,3HgCl_2$, and $4—5KI,HgCl_2$. D. F. R.

Base strength of arsine oxides and analogous compounds from the nitrogen and sulphur groups. P. Nylén (*Z. anorg. Chem.*, 1941, **246**, 227—242; cf. A., 1938, I, 250).—Vals. of pK_A (20°) for the corresponding acids formed by proton addition, determined by potentiometric titration with aq. NaOH, are: $AsMe_3O$ 3·75, $AsEt_3O$ 3·71, $SbMe_3O$ 5·36, $SeMe_2O$ 2·55, $TeMe_2O$ ~6. PMe_3O and Et_2SO are less basic than H_2O; relative vals. of pK_B (25°) in anhyd. $EtCO_2H$ [S. Terjesen] are PMe_3O 3·12, Et_2SO 3·69 (NH_2Ac 3·12). The dissociation and mechanism of hydrolysis of $AsMe_2Br_3$, $AsEt_3Br_2$, and $SbMe_3Br_2$ are discussed with reference to potentio-

metric titration data. The structures of $SMe_2 \cdot NO_3$ and of additive compounds of sulphoxides and HNO_3 are also discussed. A. J. E. W.

General theory of the isoelectric point. T. L. Hill (*J. Physical Chem.*, 1942, **46**, 417—428).—Mathematical. The treatment of the problem is extended to solutions of any no. of ampholytes. C. R. H.

Carbonate effect in the titration of magnesium chloride with alkali hydroxide. R. Näsänen (*Z. physikal. Chem.*, 1942, **A**, **190**, 183—194).—The effect of the equilibrium $Mg^{..} + HCO_3' \rightleftharpoons MgHCO_3^+$ on the titration of $MgCl_2$ with alkali is discussed theoretically, and data are presented in support of derived equations. The solubility product of $Mg(OH)_2$ in NaCl solutions has been determined (cf. *ibid.*, 1941, **A**, **188**, 272). C. R. H.

Departure of the equivalence volume from the inflexion volume in potentiometric titrations. II. I. G. Murgulescu and C. Drăgulescu (*Z. physikal. Chem.*, 1942, **A**, **190**, 174—182; cf. A., 1940, I, 230).—Theoretical. More accurate expressions are derived from a consideration of ionic activity coeffs. C. R. H.

Temperature–composition diagram of the partly miscible system water–*iso*butyl alcohol. J. J. Jasper, C. J. Campbell, and D. E. Marshall (*J. Chem. Educ.*, 1941, **18**, 540—542).—A method of obtaining data for such systems is described. L. S. T.

Freezing of binary mixtures. Schatzman (*Compt. rend.*, 1941, **213**, 124—126).—The form of the apparent solidus curve obtained when a binary mixture is cooled too rapidly for the attainment of thermodynamic equilibrium is discussed from the theoretical viewpoint. It is assumed that the solid is heterogeneous, the liquid is homogeneous and is in equilibrium with the surface layer of the solid, and that there is no diffusion. The cases of isodimorphism with eutectic, and isomorphism with and without a min., are considered. A. J. M.

Solubility diagram for the system benzene–pyridine–water. J. C. Smith (*J. Physical Chem.*, 1942, **46**, 376—380).—Data at 25° are presented in tabular and triangular diagrammatic form. The anomaly reported by Woodman and Corbet (cf. A., 1926, 19) is confirmed. C. R. H.

Ternary system lithium chloride–dioxan–water. C. C. Lynch (*J. Physical Chem.*, 1942, **46**, 366—370).—Data at 25° are presented in tabular and triangular diagrammatic form. $LiCl,H_2O,(C_2H_4)_2O_2$ has been prepared. C. R. H.

Heats of dissolution of the alkali hydrosulphides and hydroselenides, and some derived magnitudes. W. Teichert and W. Klemm (*Z. anorg. Chem.*, 1941, **246**, 3—13).—Heats of dissolution at 0° are recorded as follows: NaHS, 3·6; NaHSe, 4·1; KHS, 0·1; KHSe, −1·2; RbHS, 0·0; RbHSe, −2·0; CsHS, −0·4; CsHSe, −2·9 kg.-cal. per g.-mol.; and at 20°: NaHS, 4·5; KHS, 0·7 kg.-cal. per g.-mol. These vals. are > but parallel to those for the bromides and iodides, just as the vals. for the hydroxides are > but parallel to those for the fluorides. From the data other magnitudes are calc. as follows. Heats of formation: NaHS, 57·1; NaHSe, 30·4; KHS, 63·2; KHSe, 38·3; RbHS, 64·1; RbHSe, 39·9; CsHS, 65·7; CsHSe, 42·0 kg.-cal. per g.-mol.; heats of hydration: HS′, 83; HSe′, 76 kg.-cal. per g.-mol.; these are > the vals. for the comparable halide ions, owing to the effect of the dipole. The electron affinities of the HS and HSe groups are 53 and 44 kg.-cal. per g.-mol., and the proton affinities of the HS′ and HSe′ ions are 346 and 341 kg.-cal. per g.-mol. The former are <, and the latter >, the vals. for the corresponding halogen atoms or ions. F. J. G.

Heats of mixing in the ternary system ethanol–acetic acid–ethyl acetate by a rapid approximate method. B. Longtin (*J. Physical Chem.*, 1942, **46**, 399—405).—The method, which has an accuracy of ~5 joules per mol., is described and illustrated with data for the system EtOH–AcOH–EtOAc. C. R. H.

Thermochemical investigation of the rotation of C–C bonds. G. Jung and J. Dahmlos (*Z. physikal. Chem.*, 1942, **A**, **190**, 230—240).—From vals. for the heat of combustion of the reactants, the difference between the heats of reaction between glycol (**I**) and $COMe_2$ and between *cis-cyclo*pentanediol (**II**) and $COMe_2$ has been calc. The val. of the difference (~1·9 kg.-cal.) as an indication of the relative potential energies of the OH groups in (**I**) and (**II**) is discussed. C. R. H.

Heat of coagulation of silica.—See A., 1942, I, 266.

VII.—ELECTROCHEMISTRY.

Action of an electric field at the surface of an electrolyte. C. Cassignol (*Compt. rend.*, 1941, **213**, 868—870).—When there is a sufficiently great potential (50—80 v.) between the electrodes in electrolysis, light is emitted, usually from the electrode with the smaller surface. The voltages necessary are insufficient to cause disruptive discharge or thermionic emission. The carriers of the discharge are charges emitted by the electrolyte. A. J. M.

Relationships between standard electrode potentials of the elements and their positions in the periodic table. C. L. Deasy (*J. Chem. Educ.*, 1941, **18**, 514).—Eight relationships are pointed out. L. S. T.

Calculated and observed values of the electrode potential of ozone. E. Briner (*Helv. Chim. Acta*, 1942, **25**, 98—106).—E_0 for O_3 is calc. to be 2·07 v. at 20°. F. J. G.

Potential of the zinc–cadmium eutectic. M. Straumanis and N. Brakšs (*Korros. u. Metallschutz*, 1940, **16**, 27—33).—Measurements on electrodes of Zn–Cd eutectic alloy (17 wt.-% Zn) in various electrolytes indicate that the electrode potential tends to approach the Zn electrode potential as the rate of dissolution of the metal becomes vanishingly small, attaining such val. only in neutral solution and in the absence of air or other oxidising agent. It is inferred that in general, alloys comprising two immiscible metals will show the potential corresponding to the more electropositive component. When the rate of dissolution of the metal is appreciable, the [Zn] in the alloy is decreased, or if it is etched, the electrode potential is decreased. J. W. S.

Activation and passivation potentials in passivity phenomena. V. Čupr (*Korros. u. Metallschutz*, 1940, **16**, 10—17; cf. A., 1937, I, 141).—The self-activation of a passive Cr or Fe–Cr electrode occurs at a definite potential which is more positive than the potential required for cathodic activation of the same electrode by application of an external e.m.f. Similarly the self-passivation potential produced by atm. O_2 or O_3 is more negative than the potential required for anodic passivation. These results are discussed theoretically with reference to the effects of p_H, temp., nature of the anion present, the presence of oxidising or reducing agents, and the rate of change of the polarising potential. J. W. S.

Electrochemistry of baths of fused aluminium halides. I. Aluminium as a reference electrode. R. G. Verdieck and L. F. Yntema. **II. Deposition potentials of chromium, molybdenum, and tungsten.** E. E. Marshall and L. F. Yntema (*J. Physical Chem.*, 1942, **46**, 344—352, 353—358).—**I.** The Al electrode can be used as a reference electrode in studying diffusion potentials of metals from alkali chloride–$AlCl_3$ baths. Deposition and decomp. potentials for several metals are tabulated, the sum of the two potentials being 2·09±0·04 v. Co is abnormal.

II. Extension to Cr, Mo, and W has shown that deposition potentials of solutions of Mo^{III} and W^{III} are the same as for solutions of Mo^{VI} and W^{VI}, suggesting that reduction to the tervalent state precedes deposition in each case. C. R. H.

Oxidation-reduction potential of the system hæmoglobin–ethyl hydroperoxide. M. Polonovski, M. F. Jayle, and (Mlle.) G. Fraudet (*Compt. rend.*, 1941, **213**, 887—889).—EtO_2H oxidises the Fe of hæmoglobin to $Fe^{...}$, but the instability of the oxidised compound and its inability to form a more highly oxidised derivative distinguish it from methæmoglobin (**I**). The enzymic activity is also different from that of (**I**). Hæmoglobin is thus more than a reservoir of O, and participates in biological oxidations by its enzymic activity. A. J. M.

Contact potentials. I. General principles. II. Volta effect. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], **33**, 399—415, 416—430).—I. Definitions of terms are considered, and it is shown that the sum of the interphase p.d. is equal to the measured p.d. of the complete system.

II. The chemical and contact theories of the Volta effect are considered, and it is shown that the two theories can be reconciled if care is taken in definitions. Replacement of a vac. by a dielectric does not alter the Volta effect. The ionisation method of approaching the problem gives identical results with other methods. The relationship of the Volta effect with the Peltier effect and the photo-electric work function is discussed. A. J. M.

Origin of hydrogen overpotential. S. von Náray-Szabó (*Korros. u. Metallschutz*, 1940, **16**, 22—27).—Theories of the overpotential (η) of H are summarised and discussed critically. Experiments with Hg, Ag, Cu, and Pt electrodes in HCl and H_2SO_4 indicate that Tafel's relation $\eta = a + b \log c$ (c = cathodic c.d.) holds within experimental error and that the consts. a and b vary with the metal and electrolyte. The importance of H-adsorption in overpotential phenomena is emphasised. J. W. S.

Mechanism of overvoltage of azide and hydroxyl ions. R. Audubert and E. T. Verdier (*Compt. rend.*, 1941, **213**, 870—873).—A general equation for anodic overvoltage applies also to N_3' and OH'. A. J. M.

Theory of corrosion phenomena. XVIII. Principles of the electrochemical interpretation of corrosion processes by local cells. W. J. Müller (*Korros. u. Metallschutz*, 1940, **16**, 1—10).—The principles underlying the author's theory are discussed. The importance of the course of the c.d.–potential curves of various cells and the contributions made by the Nernst potential, overpotential, and cathodic film polarisation are emphasised and applied to the behaviour of local corrosion cells. J. W. S.

Behaviour of tocopherols at the dropping of mercury electrode.—See A., 1942, II, 235.

Amperometric titration of α-tocopherol with auric chloride at the dropping mercury electrode.—See A., 1942, III, 554.

Application of the dropping mercury electrode to the investigation of polyhydroxy-acids and lactones. H. Matheson, H. S. Isbell, and E. R. Smith (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 95—131).—Polarographic measurements in the presence of NEt_4Cl show that freshly prepared solutions of aldonic acids give the usual H-wave but no wave corresponding with the reduction of the CO_2H group. After keeping, however, the H-wave decreases and a wave due to the γ-lactone appears. In the presence of O_2 a wave, apparently caused by a product of interaction of the acid with Hg and O_2, occurs at ~−1·1 v., with accompanying decrease in the H-wave. Freshly prepared solutions of the δ-lactones of aldonic acids give waves at ~−2·3 v. apparently due to reduction of the lactones. These waves disappear when the solution is kept. The γ-lactones of aldonic acids yield waves at potentials slightly > that of the δ-lactones and on keeping their solutions the wave due to the lactone decreases in height and that due to H appears. When OH on $C_{(2)}$ and the residual C-group on $C_{(1)}$ are in *cis* positions the reduction potential of the γ-lactone is > when these groups are in *trans* positions. J. W. S.

Temperature correction devices in ion concentration measurements. F. Lieneweg (*Z. tech. Physik*, 1942, **23**, 12—16).—The theory of the effect of temp. on the e.m.f. of cell combinations used for ion concn. measurements, and its application to the design of automatic temp.-compensating devices, are discussed. With compensated glass and Sb electrodes (cf. Fischbeck and Eimer, A., 1939, I, 94; Spychalski, *ibid.*, 533) p_H errors may attain 0·1 for a temp. change of 15°, unless experimentally determined corrections are applied. A. J. E. W.

VIII.—REACTIONS.

Low-temperature oxidation of nitric oxide. L. S. Gibianski and S. Z. Roginski (*J. Phys. Chem. Russ.*, 1940, **14**, 1347—1351).—To SiO_2 gel definite vols. of O_2, of NO, or of O_2 + NO are admitted. The pressure decrease of a NO–O_2 mixture is > the sum of these decreases for O_2 and NO, showing that NO_2 is formed and is practically completely adsorbed by the gel. Thus determined, the rate of formation of NO_2 is very small at low pressures and steeply rises to a const. val. at the threshold pressure p. For O_2 25, NO 75 p has a min. val. (0·25 mm. Hg at 194° K.); it rises slightly when $[O_2]$ decreases, and steeply when $[O_2]$ increases. For O_2 33, NO 67 p rises from 0·08 mm. Hg at 178° K. to 1·95 at 273° K. The activation energy near p is 2200 g.-cal. Probably some chain mechanism is responsible for the existence of the threshold. At higher pressures SiO_2 accelerates the NO_2 formation, *e.g.*, 30-fold at 235° K. when the gases are dry. J. J. B.

Kinetics of oxidation of ethylenic hydrocarbons. C. Paquot (*Compt. rend.*, 1941, **213**, 130—131).—A reply to criticism (cf. Amiel, *ibid.*, **212**, 956). A. J. M.

Limits of inflammability and ignition temperature of styrene in air. G. W. Jones, G. S. Scott, and W. E. Miller (*U.S. Bur. Mines*, 1942, *Rept. Invest.* 3630, 5 pp.).—At the lower and upper limits of inflammability dry air–styrene (I) mixtures contain 1·10 and 6·10% of (I) respectively. The ignition temp. of (I) is 490° in air and 450° in O_2. C. R. H.

Reversible transformation of chloro- and aquo-pentammine cobaltic chlorides in dilute hydrochloric acid solutions. B. Adell (*Z. anorg. Chem.*, 1941, **246**, 303—328; cf. Sandved, A., 1935, 587).—The equilibrium $[Co(NH_3)_5Cl]^{··} + H_2O \rightleftharpoons [Co(NH_3)_5H_2O]^{···} + Cl'$ has been studied by optical extinction, potentiometric titration, and electrometric methods with 0·005—0·01M. solutions of the complexes in 0·001—0·0001M-HCl, at 25°. k vals. are calc. on the assumption that the forward change is unimol. and the reverse change bimol.; the data can be treated as if both changes were unimol., but only because the forward change predominates. The effect of ionic strength on the k vals. is examined. A. J. E. W.

Determination of esterification constants in presence of a neutral solvent.—See A., 1942, II, 215.

Displacement reactions in neopentyl halides.—See A., 1942, II, 245.

Rates of reduction of aneurin and diphosphoaneurin. Effect of aneurin on condensation reactions of pyruvate.—See A., 1942, III, 470.

Kinetics of topochemical reactions. O. M. Todes (*J. Phys. Chem. Russ.*, 1940, **14**, 1224—1228).—The rate of growth of a solid reaction product within a solid reactant is calc. for various sizes and shapes of solid particles. J. J. B.

Some problems of topokinetics. B. V. Erofeev (*J. Phys. Chem. Russ.*, 1940, **14**, 1217—1223).—There are two kinds of reaction in which a solid gives solid products. In (1) the no. of nuclei of the product originating per unit time is const., and the radius of a nucleus grows at a const. speed. The total speed of reaction is calc. for plane, linear, and point nuclei. In (2) the rate of reaction increases exponentially with time. This type is due to "infection" of neighbouring crystals by a nucleus. The difference between this explanation and the theory of chain reactions is emphasised; chains are possible only for exothermal reactions whereas "infection" is independent of the heat of reaction and is observed, *e.g.*, in the thermal decomp. of $(HCO_2)_2Co$ + 1% $(HCO_2)_2Mn$ at 218°, which is endothermic. J. J. B.

Parabolic and logarithmic oxidation of copper.—See B., 1942, I, 312.

Polymerisation of ethylene and propylene by free alkyl radicals. O. Beeck and F. F. Rust (*J. Chem. Physics*, 1941, **9**, 480—483).—Me- and Et-induced polymerisation of C_2H_4 and C_3H_6 at 350—450° proceeds by successive addition of olefine mols. to radicals. Formation of long-lived C_3H_5 radicals causes a much lower polymerisation in C_3H_6 than in C_2H_4. L. J. J.

Effect of sodium sulphate in basic chrome sulphate tanning.—See B., 1942, II, 246.

Investigation of the mechanism of catalytic reactions by means of artificially radioactive indicators. N. E. Breshneva (*J. Phys. Chem. Russ.*, 1940, **14**, 1371—1373).—When C_6H_6 reacts with Br in presence of $ZnBr_2$ containing radioactive Br the progress of the bromination is quite different from that of the exchange between Br and radioactive $ZnBr_2$. The energy of activation of the bromination is 6200 g.-cal. and of the exchange 18 kg.-cal. For the isomerisation 1-→2-$C_{10}H_7Br$ in presence of $AlBr_3$ it is 8 kg.-cal. and for the exchange in this case 20 kg.-cal. J. J. B.

Relationship of the stages of heterogeneous catalysis. S. J. Elovitsch (*J. Phys. Chem. Russ.*, 1940, **14**, 1176—1181).—The first stage of any heterogeneous catalysis is diffusion of the reactant mols. to the catalyst; since the diffusion usually has a smaller temp. coeff. than the real rate of reaction, it often determines the total rate of reaction at high temp. The next step is activated adsorption, mostly leading to formation of an intermediate compound. Activated adsorption alone is not enough, as Ni saturated with C_2H_4 does not react with H_2, and Ni saturated with H_2 does not react with C_2H_4. J. J. B.

Electrochemical methods of studying the surface of catalysts. A. N. Frumkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1200—1207).—Electrochemical charging of metal electrodes with H_2 or O_2 gives information about the surface of metals; a review of the results thus obtained is given. J. J. B.

Para–ortho transformation of hydrogen and exchange between light and heavy hydrogen on charcoal. R. Burschtein (*J. Phys. Chem. Russ.*, 1940, **14**, 1195—1199).—The para–ortho transformation in presence of C at a low temp. θ_1 is retarded if the C has previously absorbed H_2 at a higher temp. θ_2. When θ_1 and θ_2 remain const. the retardation ∝ the amount adsorbed. The retardation is the larger the lower is θ_1 (−183° to 27°) and θ_2 (300—700°). The smaller retarding effect of H_2 adsorbed at higher temp. is attributed to the possibility of H_2 occupying at high temp. surface spots requiring a higher activation energy of adsorption, these spots being less efficient as catalysts. The relative area of these spots and the activation energy of adsorption on these and on catalytically active spots are calc. The H_2 adsorbed at 500° retards also the exchange between light and heavy H at room temp. This effect shows that the adsorbed H_2 remains on the surface of the charcoal without penetrating into its lattice. If the para–ortho transformation or the H_2–D_2 exchange takes place at a temp. at which the activated absorption occurs, the latter poisons the catalyst. The rate of the transformation on active C is independent of the gas pressure and has a positive temp. coeff.; on poisoned C it ∝ the pressure and has a negative temp. coeff. J. J. B.

Catalytic combustion on surfaces. M. B. Ravitsch (*J. Phys. Chem. Russ.*, 1940, **14**, 1353—1361).—The rate r of combustion of the mixture O_2 + $2H_2$ at 400° in a SiO_2 tube is low and is raised by a SiO_2 filling > by a fireclay filling. At 900° r in the presence of fireclay is > in the presence of SiO_2. The activity of fireclay is increased by 10% of NiO or of iron oxides + 0·1% of K_2O + 0·2% of Al_2O_3; r becomes at 400° equal to that on pure fireclay at 900°. The mineral dunite, fireclay containing 10% of ThO_2 and 0·1% of Ce_2O_3, and fireclay containing pure or crude Ce oxides afford equal vals. of r at 500°. V_2O_5 improves fireclay less. The combustion on surfaces is used on a semi-large scale in boilers and furnaces. If the fuel contains only C, H, O, and N, the combustion product contains only wholesome gases (no CO) and can be used for producing a neutral atm. J. J. B.

Mechanism of the oxidation of sulphur dioxide on oxide catalysts. G. K. Boreskov (*J. Phys. Chem. Russ.*, 1940, **14**, 1337—1346).—The activity of an Fe oxide catalyst decreases below 625°, and the composition of the catalyst is Fe_2O_3 above 625° and $2Fe_2O_3,3SO_3$ below 600°. As Neumann and Heintke (A., 1937, I, 315) attributed the change of activity at 625° to the dissociation pressure of $Fe_3(SO_4)_4$ which is not present in the catalyst, their theory is disproved. Contrary to Neumann, $VOSO_4$ cannot be the intermediate product in the oxidation of SO_2 on V_2O_5 since the rate of formation

of $VOSO_4$ is too low. The mixture V_2O_5 1, Na_2SO_4 0·1 mol. shows a max. activity at 505°. The mixture V_2O_5 1, Na_2SO_4 0·1, SiO_2 8 mols. is a very active catalyst; its activity at 400—470° depends on whether this range was arrived at by heating or by cooling. J. J. B.

Optical investigations of activated adsorption. A. N. Terenin (*J. Phys. Chem. Russ.*, 1940, **14**, 1362—1369).—The absorption spectrum (*e.g.*, of I or NO_2) is only little changed by adsorption on SiO_2 gel. The rate r of decomp. of NH_3 in light is affected by adsorption; on unactivated Al_2O_3 there is a broad max. of r between 2000 and 2400 A., and on activated Al_2O_3 two max. of r (2200 and 2900 A.) are observed. The longest wave causing decomp. of $COMe_2$ is 1950 A. in the gas phase and 2200 and 2800 A. for $COMe_2$ adsorbed on unactivated and activated Al_2O_3, respectively. The Raman spectrum cannot be used for studying activated adsorption. The absorption of NH_3 in the ultra-red is not affected by adsorption on SiO_2 but the band is shifted to lower frequencies when Fe from $Fe(CO)_5$ is the adsorbent. The photochemical decomp. of MoO_3 and $PbCl_2$ is accelerated by adsorption of NH_3, NH_2Ph, or PhCHO. J. J. B.

Kinetics of ammonia synthesis. V. A. Roiter (*J. Phys. Chem. Russ.*, 1940, **14**, 1229—1240).—The rate y of synthesis referred to 1 c.c. of catalyst is related to the total pressure P, the H_2 pressure p_1, the N_2 pressure p_2, and the time τ of contact with the catalyst by the equations $y = kP^{1.25}$, $y = k_1p_1$ (p_2 being const.), $y = k_2p_2^{0.5}$ (p_1 being const.) at pressures <1 atm., and by the equations $y = k\tau^{-0.6}P^{1.6}$, $y = k_1p_1^{1.4}$, and $y = k_2p_2^{0.5}$ at 50—200 atm. These equations are empirical and cannot be exact as the sum of the exponents of p_1 and p_2 is not equal to that of P. No mechanism suggested so far accounts for these rules but the theory of Temkin and Pishev (cf. A., 1942, I, 207) is the most promising. J. J. B.

Kinetics of ammonia synthesis. M. I. Temkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1241—1245).—The rate of NH_3 synthesis is determined by the rate of adsorption of N_2, and that of NH_3 decomp. by the rate of desorption of N_2. This mechanism gives for the rate of synthesis $v_1 = k_1p_1p_2^{1.5}/p_3$ and for the rate of decomp. $v_2 = k_2p_3/p_2^{1.5}$, p_1, p_2, and p_3 being the pressures of N_2, H_2, and NH_3, respectively. These equations are in a sufficient agreement with experiment (cf. preceding abstract). J. J. B.

Decomposition of carbon monoxide by ferromagnetic metals. F. Olmer (*J. Physical Chem.*, 1942, **46**, 405—414).—Of several metals examined only Fe, Ni, and Co catalyse the decomp. of CO, decomp. beginning at 300—400°. Fe_3C is catalytically inactive. The catalytic properties of Fe are weakened at 580—590° as a result of agglomeration of Fe particles with a consequent reduction of surface available for CO adsorption. Dilution of Fe with neutral substances, *e.g.*, MgO, hinders agglomeration, and the activity of such diluted Fe is less affected by heating through the agglomeration temp. region. C. R. H.

Mechanism of the catalytic oxidation of carbon monoxide on manganese dioxide. N. Schurmovskaja and B. Bruns (*J. Phys. Chem. Russ.*, 1940, **14**, 1183—1192).—The catalytic activity of MnO_2 prepared by electrolysis gradually decreases if MnO_2 is kept in CO or used for accelerating the oxidation in CO–O_2 mixtures; in about a day a const. activity is reached. When the catalyst is in this steady state, the rate of oxidation $\propto$ [CO] and is independent of [O_2]. The initial activity is restored by O_2 at 180—200°. The activation energy at low temp. (0—50°) is 1500 g.-cal. for a fresh catalyst, and 2500 g.-cal. for MnO_2 in the steady state. At higher temp. (50—70°) the energy of activation is 12,000 g.-cal. Probably above 50° new active spots form on the surface of the catalyst. To elucidate the mechanism of the reaction CO and O_2 were admitted to MnO_2 separately. The formation of CO_2 takes place after admission of CO, showing that CO reduces MnO_2 and that the product of reduction is oxidised by O_2. MnO_2 absorbs O_2 ~3 times as rapidly as CO. J. J. B.

Kinetics of heterogeneous catalytic processes. M. I. Temkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1153—1158).—The surface of solid catalysts is not uniform. If a simple assumption is made about the relation between the area over which the adsorption coeff. is a, and the magnitude of a, then the occupied fraction of the surface is $[\log_e(1 + a_0p) - \log_e(1 + a_1p)]/[\log_e a_0 - \log_e a_1]$, p being the gas pressure and a_0 and a_1 the greatest and the smallest val. of a. The rate of a reaction on such a surface $\propto (a_0p)^\beta$, β being the ratio of the changes of the activation energy of the reaction to those of the adsorption energy on movement from an active spot to one next to it in activity. Since β is <1, the rate of many heterogeneous reactions is $< \propto p$. The theory is applicable to the discharge of ions, and in particular to overvoltage. Analogous equations can be deduced assuming the surface to be uniform but considering the repulsive forces between adsorbed mols. J. J. B.

Catalytic oxidation of acetylene. V. A. Roiter (*J. Phys. Chem. Russ.*, 1940, **14**, 1370).—$AgMnO_4$ deposited on a Mn ore is a powerful catalyst for atm. oxidation of traces of C_2H_2 at 160°; it can be used for 10^{-3}—10^{-4}% of C_2H_2 in air; concns. of 10^{-2}% poison this catalyst and require employment of activated MnO_2. J. J. B.

Catalytic hydrogenation and polymerisation of acetylene–hydrogen mixtures.—See A., 1942, II, 213.

Catalytic dimerisation of ethylene.—See A., 1942, II, 213.

[Catalytic] dehydrogenation of open-chain hydrocarbons in presence of carbon dioxide.—See A., 1942, II, 213.

Catalytic dehydrogenation of butane.—See A., 1942, II, 213.

Catalytic aromatisation of paraffin hydrocarbons.—See A., 1942, II, 252.

Catalytic isomerisation of monocyclic hydrocarbons in presence of molybdenum disulphide.—See A., 1942, II, 220.

Vanadium catalytic masses in manufacture of sulphuric acid.—See B., 1942, I, 298.

Structure and properties of heterogeneous catalysts. A. M. Rubinstein (*J. Phys. Chem. Russ.*, 1940, **14**, 1208—1216).—The apparent energy of activation of dehydrogenation of alcohols on mixed catalysts containing $Ni : Al_2O_3 = 1 : 1$ is 0·55 of the activation energy of dehydration of the same alcohols on the same catalysts; hence dehydration and dehydrogenation take place on different active spots which probably are localised along phase boundaries. The efficiency of Ni–Al_2O_3 catalysts is max. at $Ni : Al_2O_3 = 1 : 1$. The ratio of the activation energies dehydrogenation : dehydration is 0·35 for Pt on charcoal, and 0·40 for Pt on Al_2O_3; it is 1 for the unmixed catalysts Fe_2O_3 and ZnO and <1 for Cr_2O_3 and BeO since these catalysts cause carbonisation of alcohols. Dehydrogenation of alcohols in presence of Ni–Al_2O_3 catalysts is most rapid when the Ni crystals are 70—80 A. in diameter; the range investigated was 30—130 A., and the sharpness of X-ray lines used. No definite relation between the rate of dehydration and particle size of Al_2O_3 in Ni–Al_2O_3 mixtures could be established. The X-ray spacings of Ni show that its lattice is deformed; the activation energy of dehydrogenation is the higher the more compressed is the lattice. The rate of dehydrogenation of *cyclo*hexane and HCO_2H is a max. when the Ni crystals are ~80 A. but the activity of Ni for hydrogenation of C_6H_6 or CO is the higher the smaller is the particle size (40—120 A.). J. J. B.

Consecutive stages in heterogeneous catalysis. A. A. Balandin (*J. Phys. Chem. Russ.*, 1940, **14**, 1160—1175).—A review is given of the author's "multiplet" theory (A., 1936, 167). The three stages of the process, *i.e.*, the adsorption, the reaction, and the desorption, are considered in detail. New experiments are reported on hydrogenation of org. halides in presence of C; the rate of these reactions is determined by that of desorption, especially of the desorption of HCl or HBr. Under identical conditions at 400° 3% of PhBr, 28% of $CHCl_3$, 42% of Bu^nBr, 51% of $Bu^\gamma Cl$, and 58% of allyl chloride exchanged their halogen for H. In H_2O on Pt, NHAcBr and H_2 yield AcOH, NH_2Ac, HBr, Br, and NH_4Br; the rate of this reaction shows a max. when about 0·75 of the H has been consumed. It was often supposed that $Al(OEt)_3$ is an intermediate product of dehydration of EtOH in presence of Al_2O_3. The decomp. of gaseous $Al(OEt)_3$ gives Et_2O whereas C_2H_4 is produced when EtOH is passed over hot Al_2O_3. The rate of the Et_2O formation is complicated and suggests the formation of another Al ethoxide containing more Al. J. J. B.

Mechanism of dehydration and dehydrogenation of alcohols of the homologous series C_nH_{2n+1}·OH on homogeneous catalysts. A. C. Bork (*J. Phys. Chem. Russ.*, 1940, **14**, 1288—1300).—Earlier results are reviewed. The energy of activation of alcohols calc. both from dehydration and from dehydrogenation is reduced by introduction of a Me group. Various alcohols are transformed on the same active spots of a catalyst. J. J. B.

Enhancing the activity of nickel formate catalysts. D. P. Dobitschin (*J. Phys. Chem. Russ.*, 1940, **14**, 1284—1287).—To prepare an active catalyst the original system should be as far from the equilibrium as possible. When Ni catalysts are prepared from Ni formate in H_2, the H_2 current should be rapid and the temp. high (245—250°). The range 200—240° should be crossed as quickly as possible; it is advisable to introduce a paste of $(HCO_2)_2Ni$ + oil into oil preheated to 245°. The H_2 must be dry to avoid the reaction $Ni + H_2O \rightleftharpoons NiO + H_2$ which yields an inactive Ni. When the H_2 is moist, an increase of its speed is of little advantage. J. J. B.

Electrochemical preparation of sodium chlorate from aqueous sodium chloride. S. S. Joshi and K. Srinivasan (*J. Indian Chem. Soc.*, 1941, **18**, 623—630).—Current efficiency of $NaClO_3$ formation increases with temp., with increase in initial [NaCl], increase in anodic and decrease in cathodic c.d., and rises to an optimum val. with an electrode separation of 5 cm. Of a no. of addition agents investigated, $K_2Cr_2O_7$ is the most efficient. No $NaClO_3$ is formed in cells exposed to sunlight or using a.c. F. R. G.

Electrolytic and polarographic reduction of molybdenum solutions. R. Höltje and R. Geyer (*Z. anorg. Chem.*, 1941, **246**, 258—274).—The electrolytic reduction of Na_2MoO_4 (0·025M.) in 1—20N-H_2SO_4 and 1—6N-HCl has been studied by potential measurements and oxidimetric titration of the reduced solutions. Reduction proceeds through Mo^V to Mo^{III}; at low [H^+] $Mo(OH)_3$ is pptd. The in-

fluence of the acid and Mo concns. on the Mo^{VI}–Mo^{V} and Mo^{V}–Mo^{III} redox potentials is examined. Polarographic data are given for solutions of Mo^{VI} in H_2SO_4, HCl, H_3PO_4, and $HClO_4$; four waves are observed, corresponding with the processes $Mo^{VI} \rightarrow Mo^{V}$, $Mo^{V} \rightarrow Mo^{III}$ (red), $Mo^{V} \rightarrow Mo^{III}$ (green), and $Mo^{VI} \rightarrow Mo(OH)_3$. Alkaline Mo^{VI} solutions are not reducible polarographically. (Cf. A., 1942, I, 275.) A. J. E. W.

Deposition of hard bright nickel.—See B., 1942, I, 313.

Nickel-plating magnesium alloys.—See B., 1942, I, 315.

High-efficiency cyanide copper [plating] bath.—See B., 1942, I, 312.

Deposition of copper–nickel, copper–cadmium, and copper–zinc alloys from thiosulphate solutions.—See B., 1942, I, 312.

Tin-plating from stannous ammonium oxalate.—See B., 1942, I, 313.

Lead plating.—See B., 1942, I, 314.

Electrolytic polishing of silver.—See B., 1942, I, 314.

Cathodic protection [of metals].—See B., 1942, I, 317.

Mixed electrolytes of nitrates with adipates, lævulates, and β-iso-amyloxypropionates.—See A., 1942, II, 216.

Electrolysis of deuterium-containing fatty acids. III. Mechanism of propylene and propane formation during electrolysis of butyric acids. W. Schanzer and K. Clusius (*Z. physikal. Chem.*, 1942, **A, 190**, 241—253).—The electrolysis of aq. solutions of butyric acids in which one or more H atoms have been replaced by D atoms has been investigated. α-H atoms exchange with those from H_2O. C. R. H.

Chemical reactions in electric discharges. XXVII. Production of hydrazine by means of high- and low-frequency arcs burning in nitrogen–hydrogen mixtures or in ammonia. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1942, **25**, 96—97).—Arc discharges in N_2–H_2 mixtures do not produce N_2H_4. Those in NH_3 afford N_2H_4 in small yield, which is increased by using high frequencies, low pressures, and rapid streaming. F. J. G.

Activation effects on solid substances, particularly by irradiation and variation of the magnetic state. J. A. Hedvall (*Angew. Chem.*, 1941, **54**, 505—507).—The activation of HgS, CdS, CdI_2, $CdBr_2$, $CdCl_2$, and CdF_2 is reviewed. J. L. E.

Technique for examining latent image distribution.—See B., 1942, II, 247.

Photochemical reaction between bromine and chloral. H. Klug and H. J. Schumacher (*Z. physikal. Chem.*, 1940, **B, 47**, 67—92).—Br and CCl_3·CHO when irradiated with λ 4360 A. at 70—90° undergo a chain reaction yielding CO, HBr, CCl_3Br, $COBr_2$, and $CHCl_3$. The quantum yield at 90°, with partial pressures of CCl_3·CHO and Br 100 mm., and $3{\cdot}5 \times 10^{13}$ quanta absorbed per c.c., is ~120 mol. per quantum. The temp. coeff. is 1·57 per 10°. The initial rate of formation of CO ∝ [CCl_3·CHO][Br]^0[light intensity]$^{\frac{1}{2}}$. The reaction is inhibited by traces of O_2 and by CCl_3·COBr. Addition of N_2 or CCl_3Br has no effect on the rate. The main reaction is CCl_3·CHO + 2Br = CCl_3Br + CO + HBr, followed by CCl_3Br + HBr = $CHCl_3$ + 2Br. L. J. J.

Photochemical activity of mixtures of vanadic acid and tartaric acid. III. Induced circular dichroism in vanadic acid sol. Photoreduction of dichroic sol by tartaric acid in circularly polarised light. T. L. R. Char (*J. Indian Chem. Soc.*, 1941, **18**, 605—608).—Photoreduction in *d*-light by K *d*-, *l*-, or *dl*-tartrates of vanadic acid sol pre-excited in *d*-light is > in *l*-light and vice versa. F. R. G.

Action of light on cellulose solutions. E. Steurer (*Z. physikal. Chem.*, 1940, **B, 47**, 127—154).—The viscosity of methylcellulose (I)–dioxan solutions decreases irreversibly on irradiation with λλ >3130 A., at a rate independent of λ. Methylcellobiose is demethylated in similar conditions, giving CO and CH_4. End-group determinations by the method of Hess and Neumann show a decrease in the degree of polymerisation of (I) on irradiation, involving rupture of glucosidic linkages, without demethylation. L. J. J.

Effects of water on the photochemical bromination of acetophenone. E. M. Hicks, H. M. Hicks, and J. R. Sampey (*J. Amer. Chem. Soc.*, 1942, **64**, 887—889).—Photochemical bromination of COPhMe in CCl_4 is retarded by small amounts of H_2O which remove the catalytic HBr; when larger amounts of HBr have been formed, appreciable amounts remain in the CCl_4 and reaction becomes very rapid. Addition of a little conc. HCl (by increasing the [H$^+$] in the CCl_4) or P_2O_5 (by removing H_2O) accelerate the reaction. Increase of surface by addition of S is without effect. The prototropic nature of the reaction in CCl_4 is thus confirmed. R. S. C.

IX.—METHODS OF PREPARATION.

Calcium silicates. T. Thorvaldson (*Canad. Chem.*, 1942, **26**, 197—199).—A review. D. F. R.

Hydrolysis of tricalcium arsenate. H. Guérin (*Compt. rend.*, 1941, **213**, 129—130).—Investigation of the system As_2O_5–CaO–H_2O between 17° and 90° in glass vessels shows that hydrolysis takes place above 60°. When the investigation was carried out in Cu vessels, no hydrolysis occurred, even at 90°. It is concluded that the hydrolysis occurring in glass vessels is effected by alkali dissolved from the glass. A. J. M.

Double hydroxides and basic double salts. II. Mixed precipitates from calcium–aluminium salt solutions. W. Feitknecht [with M. Gerber] (*Helv. Chim. Acta*, 1942, **25**, 106—131).—Ppts. obtained by addition of NaOH to Ca + Al salt solutions or of Ca salts to Na aluminate solutions contain *basic double salts* of widely varying composition. They have layers of $Ca(OH)_2$ with every third Ca position vacant, separated by layers of basic Al salt. In presence of Ca^{++}, $Al(OH)_3$ redissolves at a lower p_H than usual. F. J. G.

Co-precipitation of radium and barium salts as a function of temperature and acidity. W. B. Pietenpol (*J. Chem. Physics*, 1942, **10**, 211—214).—More Ra than Ba is pptd. from a solution of $RaBr_2$ and $BaBr_2$ on cooling. By separating liquor from crystals at > room temp. the factor of enrichment is increased and the process of separation accelerated. Factors of enrichment have been determined for different acidities; increase in acidity decreases the crystallisation factor on cooling from boiling to room temp., but on cooling through a small temp. range the inverse occurs. The relative amounts of Ba and Ra depend on the rate of cooling, more Ra being deposited on slow cooling. W. R. A.

Double hydroxides and basic double salts. III. Magnesium aluminium double hydroxide. W. Feitknecht [with M. Gerber] (*Helv. Chim. Acta*, 1942, **25**, 131—137).—Ppts. obtained by addition of NaOH to $MgCl_2$ + $AlCl_3$ solutions or of $MgCl_2$ to Na aluminate solutions contain a *double hydroxide* of widely variable composition. It is hexagonal rhombohedral with *a* 3·09, *c* 23·7 A., and has layers of $Mg(OH)_2$ separated by layers of disordered $Al(OH)_3$, a part of the OH′ being replacable by Cl′. F. J. G.

Extraction of zinc from ammonia buffers by means of dithizone. A. Walkley (*J. Proc. Austral. Chem. Inst.*, 1942, **9**, 29—34).—Data for the partition of Zn between aq. NH_3 + NH_4 citrate and $CHCl_3$ solutions of dithizone show that Zn can be extracted readily from the aq. phase up to, at least, p_H 10·5, and that the partition of Zn is related more closely to [NH_4] than to p_H. Extraction of Zn is rapid at p_H <8. L. S. T.

Reactions in the solid state at high temperatures. XXVII. Intermediate states which appear in the formation of willemite from zinc oxide and silica in the solid state. W. Jander and H. Riehl (*Z. anorg. Chem.*, 1941, **246**, 81—99).—A study of the *X*-ray diagrams and the sorptive and catalytic activities of ZnO–SiO_2 mixtures after ignition at various temp. leads to the following conclusions. At >500° the SiO_2 surface is activated by adsorption of ZnO. This corresponds with an increase of sorptive and catalytic activity. At 500—800° with amorphous SiO_2, or at 500—700° with quartz, the sorptive and catalytic activities decrease corresponding with a firmer binding: the first Zn_2SiO_4 mols. are being formed on the SiO_2 surface. Combination begins to be detectable chemically at 700—800°, and the first *X*-ray lines of Zn_2SiO_4 are observed after ignition at 860—900°. These first crystallites have distorted lattices, and they are responsible for sharp max. of catalytic and sorptive power in mixtures ignited at ~930° for amorphous SiO_2 and at 800—900° for quartz. At higher temp. the imperfections of the lattice are rapidly healed. F. J. G.

Reactions of solid substances. CXX. Changes of the ease of dissolution of zinc oxide and chromic oxide in the course of their mutual combination. G. F. Hüttig and H. Theimer (*Z. anorg. Chem.*, 1941, **246**, 51—66).—Intermediate stages in the reaction ZnO + Cr_2O_3 = $ZnCr_2O_4$ have been investigated by means of changes in the ease of dissolution of the two oxides in acids. The *X*-ray lines of $ZnCr_2O_4$ first appear after ignition at 700°, but changes of colour and of ease of dissolution begin after ignition at 550°. With rise of temp. of ignition, the ease of dissolution of ZnO decreases whereas that of Cr_2O_3 increases at first to a sharp max. for mixtures ignited at 750°, corresponding exactly with an increase to a max. of the adsorptive power for methylene-blue. These results indicate that the ZnO is the "activator" and the Cr_2O_3 the "activated substance." The results are compared with those for analogous systems, and mechanisms suggested. F. J. G.

Preparing dry ammonia. W. Q. Bunderman (*J. Chem. Educ.*, 1941, **18**, 545).—Conc. aq. NH_3 is dropped on to dry sticks of NaOH or KOH. L. S. T.

Nitrogen bromide. M. Schmeisser (*Z. anorg. Chem.*, 1941, **246**, 284—302; cf. A., 1940, I, 265).—Full details of the prep., analysis, and properties of NBr_3,$6NH_3$ (I) are given, and the mechanism of its formation is discussed. The best yields were obtained by passing NH_3 (~2 vols.) and a mixture of N_2 and Br_2 vapour (3·6 : 1 ; 1 vol.) separately into a trap at 100°, which retained NH_4Br, and condensing

(I) in an adjacent trap at −95°. A glow discharge has no effect on the formation of (I), and does not cause N_2 and Br_2 vapour to react. A. J. E. W.

Question of the existence of the pyro- and meta-arsenic acids. N. Kolarow (*Z. anorg. Chem.*, 1941, **246**, 14—18).—Over a temp. range of 40—160°, and at pressures of H_2O vapour between 8·8 and 588·6 mm., $3As_2O_5,5H_2O$ is the only hydrate in equilibrium with aq. arsenic acid. An equilibrium diagram is given. F. J. G.

Question of the existence of free pyroarsenic acid. A. Simon and E. Thaler (*Z. anorg. Chem.*, 1941, **246**, 19—27).—The supposed $H_4As_2O_7$ obtained by Rosenheim (A., 1930, 558) consists of $3As_2O_5,5H_2O$ contaminated with mother-liquor. F. J. G.

Higher oxides of bismuth and the bismuthates. H. Martin-Frère (*Compt. rend.*, 1941, **213**, 436—437).—Addition of hot conc. aq. $Na_2S_2O_8$ to a boiling solution of $Bi(OH)_3$ in 60% aq. NaOH affords an orange-yellow ppt. of $NaBiO_3$ which can be dried in vac. over H_2SO_4 without decomp. Treatment of the dried ppt. with 5% HNO_3 at 0° for 12 hr. furnishes a residue of Bi_2O_4 but no Bi_2O_5. A. R. P.

Affinity. XCVI. Tantalum phosphides. M. Zumbusch and W. Biltz (*Z. anorg. Chem.*, 1941, **246**, 35—45).—The system Ta–P has been studied by means of tensimeter curves and *X*-rays. Ta forms two *phosphides*, TaP and TaP_2; their prep. requires the use of very finely-divided Ta and high temp. and pressure. TaP has ρ_4^{25} 10·85 and TaP_2 8·41. An unstable modification of TaP sometimes is formed by dissociation of TaP_2; it is metastable under all conditions. TaP and TaP_2 are fairly resistant to reagents, but are attacked by hot NaOH or hot HNO_3. F. J. G.

Thionylimide, SONH. P. W. Schenk (*Ber.*, 1942, **75**, [*B*], 94—99).—Interaction of $SOCl_2$ (1 mol.) and NH_3 (3 mols.) in the gaseous phase gives *thionylimide*, m.p. −85°, affording a colourless liquid which polymerises at −70° to a transparent, yellow-brown mass resembling bakelite. When polymerised it is insol. in the usual org. media except MeOH, EtOH, and $COMe_2$ with which it appears to react. H. W.

Existence of double shelled chromic acetate complexes. H. Spandau and D. Zillessen (*Z. anorg. Chem.*, 1941, **246**, 100—111).—The results of Brintzinger and Jahn (A., 1937, I, 81) cannot be confirmed by the method of Jander and Spandau (A., 1940, I, 204). F. J. G.

Existence of double shelled chromic acetate complexes. H. Brintzinger (*Z. anorg. Chem.*, 1941, **246**, 112—114).—A reply to Spandau and Zillessen (cf. preceding abstract). F. J. G.

Behaviour of molybdenum solutions towards reducing agents. R. Höltje and R. Geyer (*Z. anorg. Chem.*, 1941, **246**, 243—257).—The reduction of Mo^{VI} solutions has been studied by potential measurements and oxidimetric titration of the reduced solutions. In acid solutions Zn and Cd give successively Mo^{V} and Mo^{III}, with no evidence of Mo^{IV}. $Mo(OH)_3$ is formed from slightly acid solutions and Zn, and from neutral solutions with Zn and NH_4 salts. Hg and >4N-HCl, or Ag and >3N-HCl, give Mo^{V}, but at higher [HCl] Mo^{III} is also formed; these reactions can be used in volumetric determination of Mo. Cr^{II} in strongly acid solutions gives Mo^{III}. Ti^{III} and Sn^{II} give Mo^{V}, but reduction proceeds further with Sn^{II} and 8N-HCl. With Fe^{II} partial reduction to Mo^{V} occurs in strongly acid solutions. The action of N_2H_4, KI, KBr, SO_2, $H_2C_2O_4$, and H_2O_2 on molybdate solutions is briefly discussed. A. J. E. W.

Reactions in the solid state. XXVI. Active intermediate states which appear in the formation of tungstates, especially of copper tungstate, in the solid state. W. Jander and W. Wenzel (*Z. anorg. Chem.*, 1941, **246**, 67—80).—Combination of CuO and WO_3 begins suddenly at 500°. Preps. ignited at this temp. show a max. of ease of dissolution of WO_3, a min. of adsorptive power for dyes (which is followed by a sharp max. for preps. ignited at 440°), a sharp max. of catalytic activity for the combustion of CO (which corresponds with a marked increase of the apparent energy of activation), and the first detectable *X*-ray lines of $CuWO_4$. The first-formed crystals of $CuWO_4$ give no indications of lattice distortion. Preps. heated at >480° show no sign of combination, but a steady increase of ease of dissolution of WO_3, accompanied by a steady fall of catalytic activity, whilst at 480° the adsorptive power falls sharply, indicating in this range a gradual blocking of the CuO surface by surface combination with WO_3. The behaviour of preps. heated at 500—512° indicates that here the catalytically active material is a conglomerate of $CuWO_4$ with still unchanged CuO or WO_3. The dependence on ignition temp. of the catalytic activity of $CuWO_4$ prepared in the wet way is completely different, indicating that different active centres are present. Intermediate stages in the prep. of $ZnWO_4$ and $MgWO_4$ have little or no catalytic power. F. J. G.

Structure, properties, and mode of formation of inorganic compounds of high mol. wt. of the type of the heteropoly-acids. II. Metatungstic acid, 1-phospho-12-tungstic acid, and 1-phospho-9-tungstic acid (luteophosphotungstic acid). G. Jander and F. Exner. **III. Heteropoly-compounds of the type of arsenotrimolybdic acid (2-arseno-1-hexamolybdic acid) and phosphomolybdic acids.** G. Jander and E. Drews (*Z. physikal Chem.*, 1942, **A, 190**, 195—216, 217—229; cf. A., 1942, I, 22).—II. The stability of W and P–W complexes towards p_H changes and the nature of the hydrolysis products have been investigated. The differences in the properties of the colourless and coloured forms of 1-phospho-1-hexatungstic acid are discussed.

III. As–Mo and P–Mo complexes have been investigated and compared with the corresponding P–W complexes. C. R. H.

Hydroxo-aquo cobaltic bisdiguanide and its salts.—See A., 1942, II, 251.

Formation of nickel, cobalt, and zinc ferrites at low temperature. (Mlle.) J. Longuet (*Compt. rend.*, 1941, **213**, 483—484).—$Ni(FeO_2)_2$, $Co(FeO_2)_2$, and $Zn(FeO_2)_2$ are formed when the hydroxides are pptd. simultaneously and boiled with H_2O. The corresponding Mg, Ba, and Pb compounds are not formed under these conditions. F. J. G.

X.—ANALYSIS.

Rapid determination of concentration in liquid-in-liquid solutions. L. K. Mann and H. L. Jeter (*Stain Tech.*, 1942, **17**, 25—26).—The method depends on the agitation resulting from surface tension (γ) differences when solutions of different concns. are mixed on a slide. If a drop of liquid is placed on a thin layer of another miscible liquid, the liquids will mix with no surface disturbance if their γ are equal. If the drop has the lower γ immediate spreading occurs; if the drop has the higher γ it remains as a convex drop for some time before spreading. Using known standard mixtures, concns. of other mixtures can be quickly checked. E. E. H.

Uniform system of indirect analysis. P. Fuchs (*Angew. Chem.*, 1941, **54**, 512—516).—A survey and mathematical interpretation of indirect analytical methods, the methods being divided into six primary groups: simple and multiple gravimetric, volumetric, and combined analysis. J. L. E.

Factors to be considered in quantitative polarography. I. M. Kolthoff (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 195—200). L. S. T.

Chromatographic adsorption analysis. H. H. Strain (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 245—249).—A review. L. S. T.

Interference in drop reactions. P. W. West (*J. Chem. Educ.*, 1941, **18**, 528—532).—A discussion. L. S. T.

Elimination of the water wave in polarographic work at relatively high indifferent electrolyte concentrations. I. M. Kolthoff and E. F. Orlemann (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 321—323).—The H_2O wave and the large errors that it may cause in the polarographic analysis of solutions with a concn. of indifferent electrolyte >0·5M. are eliminated by addition of 0·01% of gelatin. L. S. T.

Detecting basicity in slightly-soluble materials. F. Feigl and C. P. J. da Silva (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 316—319).—The solid to be tested is brought in contact with a solution that can form a coloured slightly-sol. inner complex salt, the pptn. of which is just prevented by an adequate [H^+]. In such "equilibrium solutions," the introduction of OH^- or solid basic materials that react even partly with dil. acids is followed immediately by formation of a coloured ppt. Suitable equilibrium solutions are formed by adding dimethylglyoxime or thionalide to Ni^{++}, or α-benzoinoxime to Cu^{++}. Minerals, glasses, inorg. and org. substances that react are listed. L. S. T.

Sodium salt of quinizarin-6-sulphonic acid as an acid–base indicator. J. H. Green (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 249).—Comparative data recorded show that this salt can be used as an indicator in the titration of strong acids with strong bases, and weak acids with strong bases. The colour changes are yellow to pink at p_H 7·1—9·1, and pink to blue-violet at 9·1—11·5 at 20°. The indicator can be used for the colorimetric determination of p_H over the range 7—11·5. The prep. of the indicator is described. L. S. T.

Gas-volumetric method of determining chlorine and carbon dioxide by the use of zinc amalgam. H. Hohn (*Angew. Chem.*, 1941, **54**, 307—308).—Cl_2 is absorbed from a mixture with CO_2 by means of damp Zn–Hg. The method gives the [CO_2] to 0·1%. A. J. M.

Determination of fluorine as bismuth fluoride. L. Domange (*Compt. rend.*, 1941, **213**, 31—32).—BiF_3 is less sol. than CaF_2, although it is more sol. in acids. It is not hydrolysed. Its relatively high mol. wt. and its ease of separation and washing are advantages over CaF_2. The reagent is a solution of $Bi(NO_3)_3$ in AcOH. Details of procedure are given. A. J. M.

Simple micro-determination of sulphur, chlorine, bromine, and iodine in organic and inorganic material. K. Burger (*Angew. Chem.*, 1941, **54**, 479—481).—The substance is heated with K and the K_2S determined by titration with KIO_3, or the K halide by the usual methods. An accuracy of 0·3% is claimed. D. F. R.

Determination of dissolved oxygen [in water] by the dropping mercury electrode.—See B., 1942, III, 174, 175.

Turbidimetric determination of sulphates.—See A., 1942, III, 564.

Persulphate test with luminol and luminescence inductions with sulphurous acid. A. Steigmann (*J.S.C.I.*, 1942, **61**, 68).—Hæmin is preferable to Cu^{++} as a catalyst in the luminol (**I**) test for H_2O_2 (cf. A., 1942, I, 153). Luminescence of (**I**) with S_2O_8'' without a catalyst requires the presence of H_2O_2 or perborate, whereas $Fe(CN)_6'''$, OCl', and MnO_4' cause luminescence in their absence. The test will detect 10 μg. of $(NH_4)_2S_2O_8$, the dilution limit being $1 : 10^5$. Fumes from 3—4% aq. SO_2 induce luminescence of alkaline (**I**) with H_2O_2; aq. SO_2 also activates alkaline (**I**) and S_2O_8''. Treatment with aq. SO_2 improves subsequent bleaching of cloth by H_2O_2 at p_H 7·5—9·0. A. J. E. W.

Standardisation of sodium thiosulphate with potassium dichromate. B. D. Sully (*J.C.S.*, 1942, 366—368).—The reaction between $K_2Cr_2O_7$ and acidified (AcOH) KI is accelerated by a trace of Cu^{++}. The following procedure is recommended for the standardisation of $Na_2S_2O_3$: to 20 ml. of 0·1N-$K_2Cr_2O_7$ are added 5 ml. of glacial AcOH, 5 ml. of 0·001N-$CuSO_4$, and 20 ml. of H_2O, followed by 20 ml. of 15% KI. The liberated I is titrated with $Na_2S_2O_3$. Temp. should be <25°. 0·05 ml. must be subtracted from the titre to allow for I liberated by Cu^{++}. A slightly modified method of standardising $Na_2S_2O_3$ against Cu wire is also described. A. J. M.

[Determination of] sulphur in [alloy] steel.—See B., 1942, I, 310.

Volumetric determination of sulphur in coal and coke.—See B., 1942, I, 289.

Determination of free sulphur in lubricating oil.—See B., 1942, I, 293.

Rapid determination of combined nitrogen in steel.—See B., 1942, I, 310.

Determination of phosphorus by Lorenz's method. Y. E. Stourdzé (*Publ. Inst. Nac. Tecn., Rio de Janeiro*, 1941, 40 pp.).—The method of Lorenz (A., 1901, ii, 278) is preferred to that of Treadwell. F. R. G.

Determination of phosphorus in lubricating oil.—See B., 1942, I, 293.

Colorimetric determination of phosphorus in soils.—See B., 1942, III, 162.

Colorimetric determination of phosphate [in boiler water].—See B., 1942, I, 282.

Increase in the acidity of boric acid by the addition of neutral salts. Volumetric determination of boric acid. H. Schäfer and A. Sieverts (*Z. anorg. Chem.*, 1941, **246**, 149—157).—A large increase in the apparent dissociation const. of H_3BO_3 is produced by the addition of neutral salts, the effect being the greater the greater is the tendency of their cations to hydrate. If a solution of H_3BO_3 is made 3·5M. in $CaCl_2$ it can be titrated with alkali using a mixture of α-naphtholphthalein and *o*-cresol-red as indicator. At the end-point the colour change is from red-violet to blue-violet. If the solution is then diluted until the $[CaCl_2]$ is ~1·15M. the alkali used can be titrated with HCl using Me_2-yellow as indicator. If the H_3BO_3 solution is saturated with $CaCl_2,6H_2O$ titration can be carried out with Me-red as indicator. J. W. S.

Microchemical determination of silicic acid in silicates. I. P. Alimarin (*J. Appl. Chem. Russ.*, 1941, **14**, 431).—Smirnov and Isakov's method (A., 1941, I, 127) is criticised. King's method (A., 1933, 801) is preferred. N. G.

Determination of silicon, especially in steel and iron.—See B., 1942, I, 310.

Separation of silicon and tin in tin-silica mixture, welding brasses, and silicon brasses by alkali sulphate.—See B., 1942, I, 313.

Direct determination of potassium in silicate rock. H. H. Willard, L. M. Liggett, and H. Diehl (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 234—235).—The bases in insol. silicates are converted completely into perchlorates by evaporation of the silicate with HF and $HClO_4$, followed by steam-distillation at 140—150° to remove F as H_2SiF_6. After dehydration of the small residual amount of SiO_2 by means of $HClO_4$, the K is separated by extracting the sol. perchlorates with EtOAc. Removal of F by pptn. as CaF_2 (A., 1935, 1338) is untrustworthy. L. S. T.

Volumetric micro-determination of salt in butter.—See B., 1942, III, 169.

Separation of lithium from potassium and sodium by treatment of the chlorides with higher aliphatic alcohols. E. R. Caley and H. D. Axilrod (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 242—244).—$CHEtBu{\cdot}CH_2{\cdot}OH$ (**I**) is a better solvent than *iso*-$C_5H_{11}{\cdot}OH$ (**II**) for extracting LiCl from NaCl and KCl. No solubility corrections are necessary, and (**I**) need not be boiled in order to dehydrate the salts. The NH_4 stearate reaction for Li can be carried out in (**I**). The solubilities of LiCl, NaCl, and KCl in (**II**) and *n*-$C_6H_{12}{\cdot}OH$ are recorded. L. S. T.

Internal indicator method for determination of zinc in rubber compounds.—See B., 1942, II, 269.

Analytical possibilities of some hydroxybenzylidenerhodanines. A. W. Scott and T. E. Robbins (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 206—207).—The behaviour of Cd^{++}, Ag^{+}, Co^{++}, Cu^{++}, Au^{+++}, Fe^{+++}, Pb^{++}, and Hg^{+} with solutions of rhodanine, *o*-, *m*-, or *p*-hydroxy- and 3 : 4-dihydroxy-benzylidenerhodanine (**I**) is tabulated. (**I**) is the only reagent that produces a distinctive deep red colour in alkaline (NaOH) solution with Co^{++}, Mg^{++}, and Mn^{++}. The lavender-coloured lake obtained with Ni^{++} is characteristic. The slight solubility of the reagents in H_2O restricts their use as analytical reagents. L. S. T.

Extraction of metals from aqueous solutions with dithizone. Lead. L. P. Biefeld and T. M. Patrick (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 275—278).—The effects of p_H, CN', OAc', citrate (**II**), and tartrate, and amount of dithizone (**I**) used in Pb determinations are recorded. Favourable p_H ranges for extraction vary considerably with different masking anions, but only limited change occurs with variation in amount of excess of (**I**). (**II**) in extraction solutions is undesirable. L. S. T.

Determination of lead in sugars and sugar products.—See B., 1942, III, 166.

Amperometric titration of copper with [α-]benzoinoxime. A. Langer (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 283—285).—The half-wave potentials and wave heights depend on the p_H of the supporting solution, and the shapes of the titration curves depend on $[NH_3]$. For 10^{-3}M-Cu solutions, results are accurate to ~±1%. L. S. T.

Qualitative separation of copper and cadmium. D. Brawley (*J. Chem. Educ.*, 1941, **18**, 434).—Cu^{++} is pptd. as CuCNS, and the Cd^{++} as CdS from ammoniacal solution. L. S. T.

Separation of copper from cadmium with salicylaldoxime in qualitative analysis. L. P. Biefeld (*J. Chem. Educ.*, 1941, **18**, 526). L. S. T.

Separation of copper, lead, and zinc with salicylaldoxime. L. P. Biefeld and W. B. Ligett (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 359—361).—Pptn. of Zn^{++} by means of salicylaldoxime (**I**) is complete only in the range p_H 7·1—8·1. Cu^{++}, Pb^{++}, and Zn^{++} are separated by pptg. Cu^{++} with (**I**) in slightly acid (modified Me-orange) solution, and Pb^{++} in strongly ammoniacal solution in presence of much NH_4NO_3, which improves the separation from Zn^{++} and permits wider latitude in the $[NH_3]$. Zn^{++} cannot be pptd. quantitatively as the (**I**) compound in the filtrate from the pptn. of Pb^{++}. It is determined as $ZnNH_4PO_4$. L. S. T.

Photometric determination of copper in steel.—See B., 1942, I, 310.

Colorimetric determination of copper in light metal alloys.—See B., 1942, I, 315.

Microdetermination of mercury. I. Reifer (*New Zealand J. Sci. Tech.*, 1941, **23**, B, 13—15).—The solution is treated with a known excess of 0·005M- or 0·0005M-KI and titrated against 0·005M- or 0·0005M-$Ce(SO_4)_2$ using diphenylbenzidine in H_2SO_4–AcOH as indicator, CCl_4 being added to take up the I formed. I fixed as HgI_2 is found by difference. The method is accurate to ±1% with 0·05 mg. of Hg. M. H. M. A.

Phloroglucinol as reagent for the mercuric ion. G. V. Veselskaja (*J. Appl. Chem., Russ.*, 1941, **14**, 423—425; cf. A., 1938, III, 406).—Only *m*-polyphenols give ppts. with $Hg(NO_3)_2$ solutions (**I**). Phloroglucinol (**II**) is the most sensitive, giving a turbidity with 1 ml. of 0·001N-(**I**) acidified with HNO_3. Resorcinol and orcinol give a similar effect only with 1 ml. of 0·01N. solution. This reaction is sp. for Hg^{++} in presence of other metallic ions and of Hg^{+}. The Hg–(**II**) complex, $C_6H_3(OH)_3,3HgO$, is not pptd. in presence of Cl', Br', I', CN', or CNS', which must therefore be removed as Ag salts. Insol. Hg salts and org. Hg compounds except Hg rhodanine can be dissolved by heating with HNO_3–H_2SO_4 and then diluting. Decomp. to HgO by addition of alkali, and subsequent dissolution of the HgO in conc. HNO_3, can also be used. N. G.

Assay of yellow mercuric oxide ointment, U.S.P. XI.—See B., 1942, III, 170.

Spectrophotomeric determination of dysprosium, holmium, erbium, thulium, and ytterbium. C. J. Rodden (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 265—277; cf. A., 1941, I, 430).—Using a double monochromator photo-electric spectrophotometer, the transimittancies of aq. $Dy(NO_3)_3$, $Ho(NO_3)_3$, $Er(NO_3)_3$, $Tm(NO_3)_3$, and $Yb(NO_3)_3$ have been measured over the λ range 3500—10,000 A. The bands most suitable for the determination of these elements are Dy 9100, Ho 6430, Er 5210 and 6530, Tm 6840, and Yb 9500 and 9730 A. Tb and Y show no appreciable absorption in the range investigated. J. W. S.

Electrolytic determination of iron. Modified Moore method. W. H. Armistead, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 207—209).—Fe is deposited at high c.d., without stirring, from hot solutions containing Fe^{+++}, PO_4''', and excess of $(NH_4)_2CO_3$. W, NO_3, and strong oxidising agents must be absent. Large amounts of Cl', SO_4'', and PO_4''', and >1% Mn do not interfere. Small amounts of Ni, Co, or Mo are quantitatively co-deposited with large amounts of Fe. L. S. T.

Steel analyses by drop reactions.—See B., 1942, I, 310.

Photometric determination of cobalt in steel.—See B., 1942, I, 310.

Colorimetric determination of nickel with ammonia. Spectrophotometric study. J. P. Mehlig (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 289—292).—The method although not highly sensitive (max. sensitivity 500—1500 p.p.m. Ni) is satisfactory. Precision is not high, but the average of several determinations gives a result in agreement with the gravimetric dimethylglyoxime method. The $[NH_3]$ must be controlled carefully. The colour system follows Beer's law, and is stable for ~4 weeks. The effect of 60 common ions is detailed. L. S. T.

Photometric determination of chromium in iron.—See B., 1942, I, 307.

Photometric determination of molybdenum in steel and cast iron.—See B., 1942, I, 310.

Determination of tin in presence of antimony and lead. M. F. Taboury and E. Gray (*Compt. rend.*, 1941, **213**, 481—483).—The Sn is converted into $SnCl_2$, the solution treated with H_2SeO_3, and the ppt. of Se weighed. F. J. G.

Microchemical reaction for quadrivalent tin. V. A. Nazarenko (*J. Appl. Chem. Russ.*, 1941, **14**, 419—420; cf. A., 1938, I, 268).—0·001 μg. Sn^{IV} in 0·001 ml. of solution can be detected by "bridging" with 0·0005 ml. of 0·1M-$[Fe(dipyridyl)_3]SO_4$ (**I**) solution in presence of excess of NaCl and HCl. Dark red, stellar crystals and aggregates (15—20 μ.), easily distinguishable from the rose-coloured, tabular or acicular crystals of $[Fe(dipyridyl)_3]Cl_2$ (700—800 μ.), are formed. Zn and Cd also react with (**I**), but the sensitivity of the reaction is less, and the crystals are of different sizes and shapes. As^V and Sb^V do not react with (**I**). N. G.

Spark spectrographic analysis of commercial tin.—See B., 1942, I, 313.

Vanadous sulphate as a reducing agent. IV. Determination of titanium. V. Action of vanadous sulphate on organic compounds. P. C. Banerjee (*J. Indian Chem. Soc.*, 1942, **19**, 30—34, 35—40).—IV. Ti may be determined (±2—3%) by titrating potentiometrically with VSO_4 in aq. H_2SO_4 at 70—80°. In presence of Fe there are three breaks in the titration curve corresponding with $Fe''' \rightarrow Fe''$, $V'''' + V'' = 2V'''$, and $Ti'''' \rightarrow Ti'''$.

V. Nitro-compounds [*e.g.*, $PhNO_2$, $C_6H_4(NO_2)_2$, *p*-$NO_2 \cdot C_6H_4 \cdot NH_2$, picric acid], methylene-blue, and indigo, have been determined by refluxing with excess of VSO_4 in CO_2 and then titrating the V'' with Fe alum. D. F. R.

Polarographic studies. I. Determination of antimony and bismuth. J. E. Page and F. A. Robinson (*J.S.C.I.*, 1942, **61**, 93—96).—Sb and Bi can be determined polarographically in blood and urine and in preps. of Sb and Bi used in chemotherapy. The determinations are normally performed in N-HCl containing 0·1% of gelatin, but if Sb and Bi are present together, the HCl must be replaced by N-H_2SO_4. The method is sp. for Sb^{III}; Sb^V must first be reduced by boiling with aq. Na_2SO_3. The half-wave potentials (versus the saturated Hg_2Cl_2 electrode) at 25° of Sb and Bi in N-HCl, -H_2SO_4, and -HNO_3, respectively, each containing 0·1% of gelatin, are: Sb_2O_3 −0·15, −0·34, −0·17 v.; Bi_2O_3 −0·11, −0·02, −0·03 v. An improved polarographic cell is described.

Colour reactions of niobium and tantalum. A. A. Dobina and M. S. Platonov (*J. Appl. Chem. Russ.*, 1941, **14**, 421—422; cf. A., 1937, I, 265; Schapiro, A., 1939, I, 102).—For Nb the yellow coloration obtained in presence of either (*a*) pyrocatechol and NaOAc or (*b*) KCNS or NH_4CNS and $SnCl_2$ is less sensitive (1 : 2500 and 1 : 25,000, respectively) than claimed by Schapiro. Ti, Mo, W, V, or Fe interferes. The reactions suggested by Schapiro (*loc. cit.*; A., 1938, I, 584), for the higher oxides of Nb and Ta would be vitiated in presence of Mo, W, V, Ti, Zr, Hf, and Th. Of the suggested reactions for Ta, only that with brilliant-green (9·5 μg. Ta per ml.) was confirmed. N. G.

Separation and micro-determination of palladium. W. B. Pollard (*Analyst*, 1942, **67**, 184—186).—Pd is separated from the other Pt metals, but not from Au, by boiling the feebly acid chloride solution with a solution of 1 : 2-NO·$C_{10}H_6$·OH in the min. amount of dil. aq. NaOH. The washed ppt. is redissolved in HNO_3 and the solution evaporated with HCl to expel N oxides; the residue is dissolved in 10 ml. of 1 : 1 HCl and the solution treated with 1 ml. of 40% aq. $SnCl_2$ and 5 ml. of C_6H_6. The Pd is then determined by titration with a 0·5% solution of $NEt_2 \cdot CS_2Na$ until the aq. layer is nearly colourless, 5 drops of 0·01% aq. $HgCl_2$ are added, and the titration continued with shaking until the red-brown colour in the C_6H_6 just disappears. The carbamate solution is standardised against a pure Pd solution. The brown colour produced by $SnCl_2$ in $PdCl_2$ solutions containing a trace of $HgCl_2$ is sp. and will detect 0·001 mg. of Pd in 2 ml. of 1 : 1 HCl. A. R. P.

XI.—APPARATUS ETC.

Application of infra-red radiation to spot-testing. W. W. Razim (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 278).—An infra-red lamp is used to heat solutions on a spot plate. L. S. T.

Intercomparison of platinum resistance thermometers between −190° and 445°.—See B., 1942, I, 281.

Stellar radiometric equipment at Harvard College Observatory. T. E. Sterne and R. M. Emberson (*Astrophys. J.*, 1941, **94**, 412—426). E. R. R.

Colloidal suspensions of herapathite for the preparation of polarising light filters. D. A. Godina and G. P. Faerman (*J. Appl. Chem. Russ.*, 1941, **14**, 362—367).—Colloidal suspensions of herapathite capable of being oriented are prepared from quinine bisulphate and I in a viscous solution of cellulose nitrate in C_6H_6–MeOH in presence of III. The prep. of the polarising films is described. N. G.

Accuracy of the determination of concentration with photo-electric spectrophotometers. G. Kortum (*Angew. Chem.*, 1941, **54**, 442—447). D. F. R.

Recording spectrophotometer and spectropolarimeter. W. R. Brode and C. H. Jones (*J. Opt. Soc.*, 1942, **31**, 743—749).—An instrument combining a fully-automatic recording spectrophotometer and spectropolarimeter is described. J. W. S.

Rapid photographic spectrophotometry. G. E. Davis and J. W. Woodrow (*Rev. Sci. Instr.*, 1942, **13**, 223—228).—A new quartz spectrograph employs a modification of the usual photographic method, and has the advantages of high speed and the possibility of determining a large no. of vals. with only two exposures. It is applicable to solids as well as liquids and solutions. A. J. M.

Photometer for determining nitrogen dioxide concentrations [to within 0·05 mm.]. L. Harris and B. M. Siegel (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 258—260). L. S. T.

Production of equal energy spectrum. E. Lau and H. Theissing (*Physikal. Z.*, 1941, **42**, 61—63).—An arrangement of slits and filters in conjunction with a prism spectrograph is described. A. J. M.

Materials and devices of falling resistance–temperature characteristic. R. W. Sillars (*J. Sci. Instr.*, 1942, **19**, 81—84).—The use of electronic semi-conductors (*e.g.*, U_3O_8) as resistors of which the resistance decreases with rising temp. is described. The applications of such resistors to thermometry and temp. control, compensation of increase of resistance of a coil due to local changes of temp., and various other processes are described. A. J. M.

Construction and operation of a polarograph. N. H. Furman, C. E. Bricker, and E. B. Whitesell (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 333—340).—Details of construction of the instrument and of a modified electrode assembly are given. L. S. T.

Coincidence ionisation amplifier. C. Magnan (*Compt. rend.*, 1941, **213**, 476—479).—An apparatus is described for the investigation of the energy of the groups of particles formed in the disintegrations of U salts under slow neutron bombardment. It consists of two co-axial ionisation chambers with three-stage amplifiers and an electronic reversing device which blocks the indication of one amplifier while the other registers, the process alternating at the rate of 10^4 times per sec. This device controls a cathode tube, and hence energies of two particles formed simultaneously can be measured. N. M. B.

Canal-ray positive-ion sources. J. D. Craggs (*Proc. Physical Soc.*, 1942, **54**, 245—265).—The positive-ion output available from cold-cathode glow discharge tubes with a canal drilled through the cathode is discussed with reference to practical precautions and technique. Measurements of intense positive-ion currents, focussing, and electrostatic and magnetic deflexion and analysis of the beam are reported. N. M. B.

Colloidal graphite electrostatic shielding. B. H. Porter (*Rev. Sci. Instr.*, 1942, **13**, 129—130).—Aquadag with H_2O (1 : 2) is used to coat clean glass surfaces instead of employing metal shields. Baking and polishing are advantageous. Coated cardboard tube can also be used. Coated rubber tubing, which remains flexible, can be used instead of metal conduits where conductivity is required. A. A. E.

Behaviour of proportional counter amplification at low voltages. M. E. Rose and W. E. Ramsey (*Physical Rev.*, 1942, [ii], **61**, 198—199).—Studies previously reported (cf. A., 1941, I, 349) were extended to the region of low gas amplification by a method based on the comparison of currents in a counter measured at potentials above and below the threshold voltage (at which the gas amplification factor begins to depart from 1); the amplification at any voltage is then directly obtained as the ratio of these currents. The apparatus and preliminary results are briefly described. N. M. B.

Photo-electric instrument measuring quality and quantity of *X*-rays for radiographic purposes. R. H. Herz (*Brit. J. Radiol.*, 1942, **15**, 110—113).—A barrier-layer photocell is employed with a fluorescent screen. L. J. J.

Grid-controlled *X*-ray diffraction tube. A. Eisenstein (*Rev. Sci. Instr.*, 1942, **13**, 208—212).—A square wave generator is described, and its voltage is impressed on a grid in an *X*-ray tube. The grid potential varies in such a way that the electron current flows only when the voltage is sufficiently high to excite the *K* series. This modulated grid gives considerable increase in efficiency in excitation of *Kα* radiation. A. J. M.

Detection of radon by means of a proportional counter. S. C. Brown, L. G. Elliott, and R. D. Evans (*Rev. Sci. Instr.*, 1942, **13**, 147—151).—(1) Rn ($\sim 10^{-12}$ curie) is conc. in a liquid-air trap before being put into the small counter. (2) Rn is swept into the counter with He. Method (2) is the more efficient. A. A. E.

Temperature coefficients in self-quenching counters. S. A. Korff, W. D. B. Spatz, and N. Hilberry (*Rev. Sci. Instr.*, 1942, **13**, 127).—A counter filled to about 7 cm. Hg with CH_4 gave the normal quenching action on a resistance of 1 megohm, and showed no change of counting rate with temp. over the range −22° to 55°. A. A. E.

Properties and applications of the Geiger–Müller photo-electron counter. O. S. Duffendack and W. E. Morris (*J. Opt. Soc. Amer.*, 1942, **32**, 8—24).—A Geiger–Müller photo-electron counter made of quartz with a Ni cathode is described. Its performance, tested by the determination of the relative intensities of spectral lines with the counter and comparison with results obtained by photographic spectrophotometry, is satisfactory when the lines compared are close together. The counter responds linearly to linear variation of intensity of a Hg-vapour lamp. A. J. M.

Increase in resolving power of the emission electron microscope. H. Boersch (*Naturwiss.*, 1942, **30**, 120).—Modifications which increase the resolving power to 0·07 μ. are described. A. J. M.

Universal electron microscope. M. von Ardenne (*Physikal. Z.*, 1942, **43**, 11—15).—Various improvements in the design of the universal electron microscope are described. A new 0·9-mm. magnetic objective is described. The apparatus includes an objective heater which enables observations to be made up to 2000°. Photographs showing the change of ZnO into basic Zn carbonate in an atm. of CO_2, and some electron diffraction diagrams are given. A. J. M.

Resolving power of electron microscopes. M. von Ardenne (*Physikal. Z.*, 1941, **42**, 72—74).—The determination of the resolving power of electron microscopes is described. The construction of test preps. for the purpose is considered. The resolving power of modern electron microscopes is 2·2 mμ. A. J. M.

Emission-regulating circuit for an ionisation gauge. R. B. Nelson and A. K. Wing, jun. (*Rev. Sci. Instr.*, 1942, **13**, 215—217).—The circuit employs gas-filled tetrodes, and maintains const. electron emission in an ionisation gauge by control of filament temp. A. J. M.

Fluorescent lamp as voltage stabiliser. L. G. Parratt and R. G. Stephenson (*Rev. Sci. Instr.*, 1942, **13**, 233—234). A. J. M.

Modified micro-pipette for density determinations in heavy water analysis. F. Rosebury and W. E. van Heyningen (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 363—364). L. S. T.

Apparatus for precision calibration of pipettes, volumetric flasks, and burettes. W. R. Thompson (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 268—271). L. S. T.

Simple micro-burette. P. F. Holt and H. J. Callow (*J.S.C.I.*, 1942, **61**, 99—100).—An easily-made micro-burette of capacity 0·6 c.c. is of the "closed-system" type and uses air instead of Hg to expel the liquid. Certain errors in micro-titration are discussed with particular reference to the determination of Ca in solutions of its salts.

Medium for m.p. baths. J. Kamlet (*Science*, 1942, **95**, 308).—Dowtherm A (Ph_2O 73·5, Ph_2 26·5%) is liquid between 12° and 258°; neither liquid nor vapour is toxic, corrosive, or spontaneously inflammable. $\mu^{20} = 1{\cdot}5884$; sp. heat = 0·63 at 100°; d^{100} 0·995. E. R. R.

Film-contraction errors in lattice-spacing measurements. H. Lipson (*J. Sci. Instr.*, 1942, **19**, 63; cf. A., 1942, I, 27, 116).—By using steel tapes to support the film the scale remained linear within experimental error although the film had shrunk by 0·3% during a period of 4 months. D. F. R.

Accurate automatic syringe mechanism. A. L. Sims and R. C. Jordan (*J. Sci. Instr.*, 1942, **19**, 58—61).—The glass syringe and valve system is automatically operated by a series of levers attached to a 10-w. synchronous motor through a reduction and a variable gear giving a wide range of interval between successive operations. The vol. and time interval may be adjusted over a wide range. D. F. R.

Apparatus for micro-evaporations. L. T. Kurtz (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 191).—Hot air is allowed to play on the surface of the solution, which is heated by a steam jacket. 0·3 ml. is evaporated in 2—3 min. L. S. T.

Semi-micro-pyknometer for heavy water. B. J. Fontana and M. Calvin (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 185—186).—The pyknometer is filled by means of a high-vac. line, and gives, with ~1 c.c. of liquid, results reproducible to 1—2 in 10^4 without thermostatic control. L. S. T.

Apparatus for distillation of corrosive liquids as used for purification of chlorosulphonic acid. A. W. Hixson and A. H. Tenney (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 345). L. S. T.

Dialysing concentrator. C. C. Smith and C. D. Stevens (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 348—349).—Apparatus for simultaneous dialysis and concn. is described. L. S. T.

Turbidity comparator. R. P. Krebs, P. Perkins, A. A. Tytell, and H. Kersten (*Rev. Sci. Instr.*, 1942, **13**, 229—232).—An a.c. operated photo-electric turbidity comparator is described. A. J. M.

Fuzz detector for viewing glass weighing vessels in organic quantitative micro-analysis. D. F. Hayman and W. Reiss (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 357).—An optical arrangement for detecting foreign material on glass surfaces is described. L. S. T.

Apparatus for the extraction of easily-emulsified liquids with immiscible solvents. P. F. Holt and H. J. Callow (*J.S.C.I.*, 1942, **61**, 84).—A simple method is described for the extraction of aq. solutions by org. solvents with which they easily emulsify. The method is convenient for use with relatively small quantities.

Extractor for use with larger quantities of plant material. R. C. Burrell and A. C. Wolfe (*J. Chem. Educ.*, 1941, **18**, 513). L. S. T.

Optical hygrometer and its working. L. D. Mahajan (*Indian J. Physics*, 1941, **15**, 425—432). W. R. A.

Molecular models with free rotation. C. E. Black, 3rd, and M. Dole (*J. Chem. Educ.*, 1941, **18**, 424—427). L. S. T.

Thermoelectric method of measuring vapour pressure. R. R. Roepke (*J. Physical Chem.*, 1942, **46**, 359—366).—The advantages of Baldes' method are discussed (cf. A., 1934, 986 and subsequently). C. R. H.

Support for reflux condensers. E. J. Benne (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 264).—A support for a battery of six condensers is described. The condensers and flasks are not clamped, and, if desired, can be easily rotated. L. S. T.

[Crater] cutter for spectroscopic electrodes. E. S. Hodge (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 260). L. S. T.

Column packing and separation of isotopes. H. G. Thode and F. O. Walkling (*Canad. J. Res.*, 1942, **20, B**, 61—68).—The expanded shale aggregate packing described gives good results in hydrocarbon and H_2O distillations. L. J. J.

Clusius–Dickel separation tube and the physical-mathematical theory of its mode of operation and capacity. H. Jensen (*Angew. Chem.*, 1941, **54**, 405—412).—A mathematical interpretation of the thermal diffusion method for the separation of isotopes. J. L. E.

Membrane interferometer manometer. J. M. Tobias (*Rev. Sci. Instr.*, 1942, **13**, 232—233).—A thin collodion film is used as one of a pair of interferometer reflectors. Observations of fringes make it possible to determine very small changes of pressure. A change of ~0·05 mm. of H_2O can be detected. A. J. M.

Vibrograph used as a viscometer. T. Tirunarayanachar (*Indian J. Physics*, 1941, **15**, 417—423).—η of highly viscous liquids can be compared by a method involving an improved form of vibrograph which photographically records the damped oscillations. For glycerol at various temp. $\eta\rho \propto$ a function of damping coeffs. of the instrument. W. R. A.

Rotary viscosimeter for determination of high consistencies. R. N. Traxler, J. W. Romberg, and H. E. Schweyer (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 340—344).—Details of design and operation, and results for asphalts over the range 0·001 to 10^3 megapoises, are given. L. S. T.

[Sintered-glass] filtering device for viscosity tubes. S. J. Hetzel (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 288). L. S. T.

Viscosimetric characterisation of particle size of high polymerides. A. Matthes (*Angew. Chem.*, 1941, **54**, 517—520).—A mathematical criticism of Staudinger's method for viscosity determinations and the concn. limits within which the formulæ used give accurate results. J. L. E.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Demonstration of adsorption [of coloured ions]. G. W. Smith (*J. Chem. Educ.*, 1941, **18**, 432). L. S. T.

Experiment in electrical calorimetry. [Reduction of dilute ferric chloride by dilute stannous chloride in 2N-hydrochloric acid.] I. Cameron and R. H. Wright (*J. Chem. Educ.*, 1941, **18**, 510—513). L. S. T.

Organic demonstration. [Reaction between β-amino*iso*butyl alcohol and α-ethylhexaldehyde.] M. Senkus (*J. Chem. Educ.*, 1941, **18**, 595). L. S. T.

Early chemistry at Le Jardin du Roi. C. de Milt (*J. Chem. Educ.*, 1941, **18**, 503—509). L. S. T.

Lewis Reeve Gibbes and the classification of the elements. W. H. Taylor (*J. Chem. Educ.*, 1941, **18**, 403—407). L. S. T.

XIII.—GEOCHEMISTRY.

Waters of the Scotian shelf. H. B. Hachey (*J. Fish. Res. Bd. Canada*, 1942, **5**, 377—397).—Temp. and salinities of the "upper," "intermediate," and "bottom" layers are given. The submarine physiography of the shelf is important in preventing interchange below 50 m. of the deeper waters at the N.E. (salinity 3·24—3·445%) and the remainder (salinity 3·12—3·288%). R. G. W.

Basin of the Río Nágima [Spain]. J. Mendizábal and M. de Cincúnegui (*Inst. Geol. Min. España*, 1941, **8**, 93—126).—Geological and hydrographical data with analyses of the H_2O supply are given. F. R. G.

Determination of the orientation of section planes of meteoritic irons. M. H. Hey (*Min. Mag.*, 1942, **26**, 141—166).—Graphical methods are described for determining the crystallographical orientation from the direction of lines of the Widmanstetter pattern and also from Neumann lines and oriented enclosures. L. J. S.

Stone-iron meteorites called pallasites: synthetic study of their structure and probable mode of formation. (Lord) Rayleigh (*Proc. Roy. Soc.*, 1942, **A, 179**, 386—393).—Pallasites consist of a sponge of Ni-Fe enclosing olivine. The structure can be closely imitated by pouring molten solder into a compact layer of stone fragments, round or angular according to the type of pallasite to be imitated. G. D. P.

Crystalline structure of chloritoid. F. Machatschki and F. Mussgnug (*Naturwiss.*, 1942, **30**, 106).—Chloritoid (sismondine, masonite) has *a* 5·4, *b* 9·4 A. The structural formula is $\frac{2}{3}Fe^{++}(OH)_2\{(OH)_2(Fe,Al,Mg)_3[(Si,Al)_4O_{10}]\}$. A. J. M.

Tricalcium disilicate (rankinite), a new mineral from Scawt Hill, Co. Antrim. C. E. Tilley (*Min. Mag.*, 1942, **26**, 190—195).—Minute crystals of $3CaO,2SiO_2$ occur with wollastonite, larnite, and melilite in melilite-rocks and at the contact of flint nodules in metasomatised chalk (A., 1934, 505). Their identification (monoclinic, α 1·641, β 1·644, γ 1·650, 2V 64°, positive) was aided by comparison with crystals in lime-rich iron-furnace slag (SiO_2 39·47, Al_2O_3 7·96, CaO 46·39%, etc.) and in recryst. limestone fragments in glass from bottle works. L. J. S.

Lamellar structure in orthopyroxenes. N. F. M. Henry (*Min. Mag.*, 1942, **26**, 179—189).—A lamellar structure often shown by orthorhombic pyroxenes (enstatite and hypersthene) has been ascribed to the exsolution of monoclinic pyroxene in the crystal. It is now shown that the lamellæ are also orthorhombic but that their *c*-axes are slightly inclined to that of the host. L. J. S.

Orientation of Widmanstetter figures in a random section. S. Melmore (*Min. Mag.*, 1942, **26**, 167—171).—The shadow of a face of the rhombic-dodecahedron is made to coincide with the lines of the Widmanstetter figures. The method is applied to determine the orientation of the crystals in the Gibeon mass (A., 1941, I, 351). L. J. S.

Gold quartz veins of Grass Valley, California. W. D. Johnston, jun. (*U.S. Geol. Survey, Prof. Paper*, 194, 1940, 101 pp.).—The chief geological feature of the district is a body of early Cretaceous granodiorite, and the oldest rocks belong to the Calaveras formation, of Carboniferous age. The igneous rocks, other than granodiorite, include diabase, porphyrite, amphibolite schists, serpentine, gabbro, diorite, quartz porphyry, and many kinds of dyke rocks. Mining conditions are unusually favourable, and the mine waters contain mainly $Ca(HCO_3)_2$ and $CaSO_4$. Quartz (I) of four different types is the principal vein mineral. Au occurs both in (I) and in cracks in broken sulphides, principally pyrite, and the average Au content of the ore mined has been 0·25—0·5 oz. per ton. Two main stages of primary or hypogene mineralisation are recognised and described. Au is commonly associated with and contemporaneous with galena. The distribution of Au in the ore shoots is very erratic. The chemical changes in the wall rocks consisted mainly of the introduction of CO_2, K, and S, and the removal of SiO_2 and Na. The (I) was deposited by dil. aq. solutions in open fissures, and the vein-depositing solutions are believed to have been wholly of magmatic origin. The mines of the district are described. L. S. T.

Geology of the Konongo Gold Belt and surrounding country. T. Hirst (*Bull. Imp. Inst.*, 1942, **40**, 36—61).—Three chemical analyses of granites are recorded. L. S. T.

Genetic correlation of cinnabar and some gold-silver deposits. H. J. Fraser (*Econ. Geol.*, 1939, **34**, 468).—Cinnabar (I) deposits are a unique type of almost monomineralic sulphide mineralisation characterised by shallow depths of formation and probably very low temp. Au-Ag deposits of the near surface type show much greater variety of associated minerals and structural types. The metallic elements present are remarkably similar in both these types. Western (I) deposits contain a relative concn. of Fe, Cr, Mn, Cu, Zn, Pb, Co, Ni, Ge, As, Sb, Au, and Ag. Cu, Ag, Pb, Co, and Ge are present, apparently as solid solutions, in (I) in amounts $\gg$ those in the adjacent wall rock. The Au-Ag deposits generally contain Fe, Cu, Pb, Zn, Au, Ag, Sb, and Hg in amounts sufficient to form characteristic minerals. Other elements, present probably in solid solution, include Co, Mn, Cr, Ga, Ni, and Mo. The solutions forming Au-Ag deposits of the very near surface type and (I) deposits appear to differ chemically only in the quant. proportion of the elements present. L. S. T.

Quicksilver deposits in and near Lake County, California. C. P. Ross (*Econ. Geol.*, 1939, **34**, 467—468).—The deposits in the Mayacmas are probably Pliocene, and those of Sulphur Bank are so recent that deposition of cinnabar (I) is continuing. Many individual seams are lined solely with (I), but dolomite and SiO_2 may occur. (I) forms rarely by replacment. Hydrocarbons are widespread in the ore. Ni minerals in small amount are conspicuous in the Mayacmas district, and are derived presumably from the serpentine. The (I) lodes are almost free from other metals. L. S. T.

Evolution of the central Texas granites. S. S. Goldich (*J. Geol.*, 1941, **49**, 697—720).—Chemical analyses and petrographic data for 5 granites, a granite-porphyry dike rock (llanite), and an aplite in the Llano uplift region of Texas are recorded and discussed. A close relationship is indicated by these data, and the variation of oxides with SiO_2 content (68—77%) is shown diagrammatically. The origin of the granites, which may have been evolved by the fractionation of one or more chemically-analogous liquids, is discussed. L. S. T.

Wall-rock alteration at Night Hawk Peninsular mine, Night Hawk Lake, Ontario. A. R. Byers (*J. Geol.*, 1941, **49**, 279—291).—Ore bodies in the mine lie in or near a stock of albite syenite intruding Keewatin lavas. The deposit consists of carbonate zones carrying disseminated sulphides, and cut by auriferous quartz stringers. Geological and mineralogical features are described briefly. Carbonate alteration (ankeritisation) is the dominant type of wall-rock alteration; it has affected large vols. of the syenite, and is most intense within the zones of Au mineralisation. Development of sericite and fuchsite accompanies the carbonatisation. Chloritisation is intense near the carbonated zones. Chemical analyses of the unaltered and altered syenite show large decreases in SiO_2, Na_2O, and Al_2O_3, except with the chloritised syenite where Al_2O_3 has been added. FeO, MgO, CaO, K_2O, and S have increased. The mineralising solutions were probably very dil., hot, alkaline waters containing CO_2, alkali carbonates, and H_2S as their main constituents. The Au was transported as a double sulphide of the alkalis, or as an alkali S-salt. L. S. T.

Some minerals of the lavas of the Puy chain. Y. Bentor (*Compt. rend.*, 1941, **213**, 289—292).—Quartz is rare, tridymite more frequent, and cristobalite widespread throughout most of the acid rocks; it is magmatic in origin. Kaersutite, TiO_2 8·77, Na_2O 2·12, K_2O 0·98, and MnO 0·13%, is abundant. Pseudobrookite and orthite are also described. L. S. T.

Observation of clay minerals using the electron microscope. H. Inuzuka (*Amer. Min.*, 1941, **26**, 448—449).—Under the electron microscope, Kibushi clay shows no definite crystal forms, but a semi-transparent membrane, probably of org. matter, supporting aggregations of grains. In pure kaolinite, crystal forms, but no membrane, can be recognised. L. S. T.

Adsorbent clay found in the rhyolitic cinerites of the Bourboule (Puy-de-Dome). (Mlle.) S. Caillère (*Compt. rend.*, 1941, **213**, 489—491).—The clay is found as a syrupy mass containing ~90% of hygroscopic H_2O. The dried material consists of an intimate mixture of kaolinite and montmorillonite, both containing considerable amounts of Fe. F. J. G.

Specification of siderolithic clays subordinate to the formation of the Perigord sands, in Dordogne. J. de Lapparent (*Compt. rend.*, 1941, **213**, 111—114).—The clays of the region are associated with montmorillonite (I). The kaolinite group is represented either by kaolinite (II) or by halloysite (HI). The (HI) of the Dordogne district differs from that occurring elsewhere. It is almost isotropic, only weak birefringence being observable. (I) forms transparent masses, faintly coloured green or pink, and is easily cut with a knife. The *X*-ray diagram is similar to that given by (I) from other parts of the world. In some argillaceous masses (I) and (II) occur in equiv. proportions. Some green clays of this district are composed of a mixture of (I), (II), and attapulgite. A. J. M.

Origin of kaolin. W. Lindgren (*Inst. Geol. Min. España*, 1941, **8**, 87—92).—Formation of kaolin is attributed to the action of H_2O containing CO_3'' and SO_4'' on the earth's surface. F. R. G.

Kaolin deposit at Cances near Carballo (Coruña). P. H. Sampelayo (*Inst. Geol. Min. España*, 1941, **8**, 81—82).—The deposit is described. F. R. G.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

SEPTEMBER, 1942.

I.—SUB-ATOMICS.

Resonance broadening of cæsium. C. Gregory (*Physical Rev.*, 1942, [ii], **61**, 465—469).—Studies of broadening by the contour method and of intensities by the method of "astigmatic photometry," with homogeneous Cs vapour at 10^{-2}—17·5 mm. pressure, show that the half-breadth (γ) $\propto$ the no. of atoms per unit vol., with $(\gamma_1/N)10^7 = 1{\cdot}45$ and $(\gamma_2/N)10^7 = 0{\cdot}84$ for the $^2P_{3/2}$ and $^2P_{1/2}$ components of the resonance lines, respectively. The average val. of the ratio of half-breadths γ_1/γ_2 is 1·8. A band on the red side of the $^3P_{3/2}$ component and one on the violet side of the $^3P_{1/2}$ are observed. N. M. B.

New type of vector coupling in complex spectra. G. Racah (*Physical Rev.*, 1942, [ii], **61**, 537).—Mathematical. A (*jl*) coupling is examined. N. M. B.

Deep configuration of cobalt. G. Racah (*Physical Rev.*, 1942, [ii], **61**, 537—539).—Marvin's theoretical work (cf. A., 1935, 675) as a basis for assignments by Russell (cf. A., 1940, I, 423) is disputed, and revised assignments are proposed and tabulated. N. M. B.

Forbidden doublet ^4S–^2D of the neutral nitrogen atom in the spectra of certain auroras seen at low latitudes. J. Dufay and M. L. Tcheng (*Compt. rend.*, 1941, **213**, 692—694).—Observations of this doublet are recorded, indicating that there must be a high concn. of N atoms excited to the ^2D level in the higher atm. A. J. M.

Presence of forbidden lines in the night sky and the aurora spectra, and the constitution of the upper atmosphere. J. Gauzit (*Compt. rend.*, 1941, **213**, 695—697).—Consequences of the occurrence of forbidden lines in these spectra are discussed. At a height of 100 km. N and O must exist almost entirely in the at. state. A. J. M.

***L*-Emission and absorption spectra and characteristic levels of tantalum (^{73}Ta).** (Mlle.) I. Manescu (*Compt. rend.*, 1941, **213**, 1007—1010).—The *L*-spectra of Ta are investigated and new lines measured. The characteristic *L*, *M*, *N*, and *O* levels are evaluated. A. J. M.

***K*-Absorption edges of metal ions in aqueous solution.** W. W. Beeman and J. A. Bearden (*Physical Rev.*, 1942, [ii], **61**, 455—458).—Measurements with a double-crystal spectrometer show that Ni^{++}, Cu^{++}, and Zn^{++} have similar edges, each consisting of two absorption max. arising from the excitation of *K* electrons into the empty 4*p* and 5*p* levels of the ion. $Cu(NH_3)_4^{++}$ and $Cu_2(CN)_4^{--}$ have entirely different structures, arising probably from the scattering of the photo-electrons by the other atoms of the ion. N. M. B.

Radiofrequency spectrum of indium. Nuclear spin of ^{113}In. T. C. Hardy and S. Millman (*Physical Rev.*, 1942, [ii], **61**, 459—465).—The at. beam method is applied, and lines of the transitions $\Delta F = 0$, $\Delta m = \pm 1$ are observed, in magnetic fields of 3000—7000 gauss, for ^{113}In and ^{115}In. A nuclear spin of 9/2 for ^{113}In is confirmed, and the moment, as for ^{115}In, is positive. The ^{115}In/^{113}In hyperfine separation ratio of the ground state is $1{\cdot}00224 \pm 0{\cdot}00010$, and this is also the ratio of the magnetic moments. For ^{115}In, the hyperfine structure val. is $(11413 \pm 3)10^6$ cycles per sec., and the nuclear moment $5{\cdot}49 \pm 0{\cdot}04$ nuclear magnetons. N. M. B.

Photo-electric instrument measuring quality and quantity of *X*-rays for radiographic purposes.—See A., 1942, I, 280.

Properties and applications of the Geiger-Müller photo-electron counter.—See A., 1942, I, 281.

Thermionic properties of the iron group. H. B. Wahlin (*Physical Rev.*, 1942, [ii], **61**, 509—512).—The temp. scales for Fe, Ni, and Co are determined for vac.-heat-treated specimens. The thermionic work functions are β-Fe 4·48, γ-Fe 4·23, Ni 4·61, and Co 4·40 e.v. Discrepancies from available data and the effect of traces of impurities are discussed. N. M. B.

Temperature scale, thermionics, and thermatomics of tantalum. M. D. Fiske (*Physical Rev.*, 1942, [ii], **61**, 513—519).—Following a determination of the temp. scale with emissivity, data found were: electron work function $\phi_0^- = 4{\cdot}19$, positive ion function $\phi_0^+ = 10{\cdot}0$, work function of the neutral atom $\phi_0^0 = 7{\cdot}97$, estimated ionisation potential $V = 7{\cdot}3$ e.v. These vals. fail to close the cycle $\phi_0^- + \phi_0^+ = \phi_0^0 + V$ by 1·1 e.v., which is probably outside experimental error. N. M. B.

V^3I Relation for vaporising molybdenum. F. T. Worrell (*Physical Rev.*, 1942, [ii], **61**, 520—524).—Langmuir's relation V^3I = const., for filaments electrically heated to const. temp. in vac., is investigated. For 500-min. operation at 2250° K., V^3I decreases by 0·49—0·85%. N. M. B.

Ionospheric measurements during the total solar eclipse of Oct. 1, 1940. A. J. Higgs (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 24—34).—The ionisation curve indicates that the radiation producing the *E* region comes mainly from regions of the sun's disc near patches of bright *H* and is not emitted uniformly. The F_1 region is more complex than is generally supposed. There is an ultra-violet effect in the F_2 region, but no corpuscular effect. W. J.

Canal-ray positive-ion sources.—See A., 1942, **I**, 280.

Coincidence ionisation amplifier.—See A., 1942, I, 280.

Behaviour of proportional counter amplification at low voltages.—See A., 1942, I, 280.

Temperature coefficients in self-quenching counters.—See A., 1942, I, 281.

Increase in resolving power of the emission electron microscope.—See A., 1942, I, 281.

Universal electron microscope.—See A., 1942, I, 281.

Resolving power of electron microscopes.—See A., 1942, I, 281.

Emission regulating circuit for an ionisation gauge.—See A., 1942, I, 281.

Detection of radon by means of a proportional counter.—See A., 1942, I, 281.

Radio-elements in non-equilibrium systems. W. D. Urry (*Amer. J. Sci.*, 1942, **240**, 426—436).—An equation for the relative amounts of the long-lived members of the ^{238}U series at any time prior to the establishment of radioactive equilibrium is derived. L. S. T.

Resonance absorption of neutrons in rhodium, antimony, and gold. H. Feeny, C. Lapointe, and F. Rasetti (*Physical Rev.*, 1942, [ii], **61**, 469—475).—The experiments reported for the resonance neutrons of Rh, ^{121}Sb, and Au are absorption in the element itself, absorption in B, and measurement of the total activation in an extended vol. of homogeneous material. The consts. evaluated are the resonance energy E_r, the absorption coeff. for self-indication K_r, and the level width Γ. The vals. found were: for Rh, $\Gamma = 0{\cdot}16$ e.v.; for Sb, $E_r = 14$ e.v., $K_r = 4$ sq. cm. per g., $\Gamma = 0{\cdot}8$ e.v.; for Au, $E_r = 2{\cdot}6$ e.v., $K_r = 40$ sq. cm. per g., $\Gamma = 0{\cdot}11$ e.v. The observed absorption coeff. for thermal neutrons in Rh and Au agrees with calculation; in Sb the calc. val. is ~6 times the observed val., suggesting the interference effect of negative levels. N. M. B.

Angular distribution of protons scattered by high-energy neutrons. H. Tatel (*Physical Rev.*, 1942, [ii], **61**, 450—454).—11-Me.v. Be neutrons are scattered in H_2 and the recoil protons observed at two different angles. The proton intensity $\propto \cos\theta$ (θ = scattering angle); hence the scattering in the centre of gravity system is isotropic to within 10%. N. M. B.

Importance of neutrons in chemistry. H. Suess (*Angew. Chem.*, 1940, **53**, 522—524).—The production and properties of the neutron and its use in connexion with nuclear transformations are discussed. Possible uses in chemical and biological research are outlined. C. R. H.

Radioactive isotopes of nickel and their assignments. M. E. Nelson, M. L. Pool, and J. D. Kurbatov (*Physical Rev.*, 1942, [ii], **61**, 428—431; cf. Livingood, A., 1938, I, 339; Doran, A., 1941, I, 439).—An investigation of the reactions Fe (α, n), Co $(d, 2n)$, Ni (d, p), Ni (n, γ), and Ni $(n, 2n)$ indicates the assignments ^{63}Ni (2·6 hr.) and ^{57}Ni (36 hr.). Ni (2·1 min.) is not confirmed. N. M. B.

Forbidden transitions in β-decay and orbital electron capture and spins of nuclei. R. E. Marshak (*Physical Rev.*, 1942, [ii], **61**, 431—449).—Mathematical. A general formula for min. lifetimes for the transitions is derived. The Gamow–Teller selection rules are supported. Results applied to ^{40}K, ^{87}Rb, ^{176}Lu, ^{10}Be, and ^{14}C are discussed. N. M. B.

Thick-target yield of ^{24}Na under denteron bombardment. C. L. Bailey and J. H. Williams (*Physical Rev.*, 1942, [ii], **61**, 539).—The yield from the reaction $^{23}Na + {}^{2}H \rightarrow {}^{24}Na + {}^{1}H$ is studied in the range 1·5—3·0 Me.v. and plotted. Results fit the Gamow thin-target formula plotted for two vals. of nuclear radius. N. M. B.

Disruption of heavy nuclei. F. Strassmann (*Angew. Chem.*, 1941, **54**, 249—252).—A review. H. W.

Formation of penetrating particles of great divergence by cosmic radiation. J. Daudin (*Compt. rend.*, 1941, **213**, 348—351; cf. A., 1942, I, 256). J. W. S.

Measurement of the mass of mesotrons by elastic collision. R. Richard-Foy (*Compt. rend.*, 1941, **213**, 724—726).—A mathematical consideration of the scope of the collision method for determining the mass of mesotrons in the Wilson chamber. J. L. E.

Effect of cosmic rays on the conductivity of hexane. G. Moulinier (*Compt. rend.*, 1941, **213**, 802—803).—There is evidence that highly purified hexane surrounded by 6 cm. of Pb undergoes ionisation by the action of cosmic rays. N. M. B.

Hypothesis as to the origin of cosmic rays and its experimental testing in India and elsewhere. R. A. Millikan, H. V. Neher, and W. H. Pickering (*Physical Rev.*, 1942, [ii], **61**, 397—407).—There is support for a theory involving the existence of 5 distinct bands, those of Si, O–N, C, and He, each reaching the earth in a particular latitude, and of 4 plateaux of unchanging cosmic-ray intensity. N. M. B.

High-altitude cosmic-ray survey near the magnetic equator. H. V. Neher and W. H. Pickering (*Physical Rev.*, 1942, [ii], **61**, 407—413). N. M. B.

Cosmic-ray electrons of low energy in the atmosphere. B. Rossi and S. J. Klapman (*Physical Rev.*, 1942, [ii], **61**, 414—421).—Mathematical. N. M. B.

Production of neutrons and protons by the cosmic radiation at 14,125 feet. S. A. Korff and E. T. Clarke (*Physical Rev.*, 1942, [ii], **61**, 422—427).—Rates of production are investigated by means of BF_3-filled counters for slow neutrons produced in H_2O, and by CH_4-filled counters for protons produced in Pb, Al, and Cu. N. M. B.

Distribution function. C. W. Ufford and E. P. Wigner (*Physical Rev.*, 1942, [ii], **61**, 524—527).—The function for particles in a large circle is calc. for a long-range repulsive potential and compared with the solution of a Debye–Hückel type equation. N. M. B.

II.—MOLECULAR STRUCTURE.

Possible presence of Lyman bands of nitrogen in the ultra-violet radiation from the night sky. G. Déjardin (*Compt. rend.*, 1941, **213**, 360—363).—A no. of bands observed in the night-sky spectrum in the λ range 2850—3650 A. coincide with calc. $\lambda\lambda$ of Lyman ($a\,{}^{1}\Pi \rightarrow X\,{}^{1}\Sigma$) bands (cf. Birge and Hopfield, A., 1928, 964) with v', v'' vals. ranging from 0, 16 to 9, 27. J. W. S.

Sodium hydroxide in interstellar space. R. C. Pankhurst and R. W. B. Pearse (*Nature*, 1942, **149**, 612—612).—Consideration of calc. and observed intensities of $R(0)$ lines of $v' \leftarrow 0$ bands of NaH supports Adams' assignment of an interstellar line, λ 3934·3, to NaH (cf. A., 1942, I, 221), but indicates that other interstellar NaH lines should be identified if the assignment is correct. W. J.

Potential energy curve of the excited state of KH. G. M. Almy and A. C. Beiler (*Physical. Rev.*, 1942, [ii], **61**, 476—481).—An analysis of the 4150—4650 A. region of the $^{1}\Sigma \rightarrow {}^{1}\Sigma$ band-system of KH is reported and compared with available data. Mulliken's explanation of the excited state anomaly of an alkali hydride is supported, for KH, by the construction of a potential curve. As in LiH, the curve of the excited state crosses the ionic curve of K^+ and H^- and dissociates apparently into K (^{2}P) and H (^{2}S). N. M. B.

Vibration–rotation energies of polyatomic molecules. H. H. Nielsen (*Physical Rev.*, 1942, [ii], **61**, 540; cf. A., 1942, I, 131).—Mathematical corrections. N. M. B.

Infra-red absorption spectra of the water molecule in crystals. W. Lyon and E. L. Kinsey (*Physical Rev.*, 1942, [ii], **61**, 482—489).—Absorption spectra near 3 μ., observed under high resolution and dispersion, as produced by H_2O in various bound states, are reported for $NaBr,2H_2O$ (3—2 μ.), $NaI,2H_2O$ (near 2·5 μ.), $BaCl_2,2H_2O$, beryl, mica, topaz, and quartz. The bands in beryl, very similar to the bands of H_2O in CCl_4, are caused by monomeric H_2O or vapour-like mols. in solid solution in the open crystal lattice. In mica only bound OH groups are present; in topaz both bound OH groups and highly perturbed co-ordinated H_2O exist; and in fused quartz H_2O exists, in some samples, in solid solution. N. M. B.

Comparison of absorption spectra of sodium chloride in heavy and in ordinary water. (Mlle.) J. Doucet and B. Vodar (*Compt. rend.*, 1941, **213**, 996—998).—At all concns. studied D_2O solutions of NaCl absorb less than H_2O solutions of the same concn. The weak band at 2700 A. is in exactly the same place and has approx. the same intensity for solutions in H_2O and D_2O, making it probable that it is due to Cl^-. A. J. M.

Effect of temperature and dilution on the near infra-red absorption spectrum of nitric acid. Associations of acid and oxygenic components. R. Dalmon (*Compt. rend.*, 1941, **213**, 782—785).—Variation of intensity with temp. indicates two components for the 1017 μ. band; this is confirmed by a study of the spectra of solutions of pure HNO_3 in CCl_4 and in $CHCl_3$. The components are compared with the alcoholic OH bands. The spectra of HNO_3 in Et_2O and dioxan are discussed. N. M. B.

Ultra-violet absorption of aqueous ammonia solutions. (Mlle.) G. Delivre, (Mlle.) M. Tintant, P. Guenin, and B. Vodar (*Compt. rend.*, 1941, **213**, 566—568; cf. A., 1935, 1298).—Extinction coeffs. (ϵ) at 2190, 2200, and 2210 A. are recorded graphically for 0·02—16M-NH_3 at 20°. At 2000 A. and c = 0·005—1M. Beer's law is approx. verified, but at ~2200 A. the ϵ curves have a min. at c = ~4M., due to an equilibrium between NH_4^+,nH_2O (predominating at low c) and NH_3,nH_2O. At c <4M. ϵ rises steadily owing to increasing solvation. A. J. E. W.

Infra-red spectra of ammonium halides. D. Williams (*J. Amer. Chem. Soc.*, 1942, **64**, 857—860).—The transmissions of powdered and aq. NH_4F, NH_4Cl, and NH_4Br have been measured and near 7 μ. agree with the results of Reinkober (A., 1926, 108). The bands at 5·8 and 7 μ. appear at lower $\lambda\lambda$ in solutions. W. R. A.

Light absorption of cobalt chloride solutions. II. Non-aqueous solutions. A. von Kiss and M. Richter (*Z. physikal. Chem.*, 1940, **A, 187**, 211—226; cf. A., 1937, I, 517).—The absorption spectra, at $\lambda\lambda$ 200—700 mμ., of solutions of $CoCl_2$ in H_2O and various H_2O–non-electrolyte mixtures, and of anhyd. $CoCl_2$ and the $CoCl_2$–C_5H_5N and –quinoline complexes in org. solvents are measured. The formation of complexes of the type $CoCl_2(Liq.)_2$ or, in the presence of excess of Cl′ ion, $CoCl_4$ is indicated. $CoCl_4(C_5H_5N)_2$ is formed in C_5H_5N solution in the presence of excess of Cl′ ion, and dissolves in $CHCl_3$ probably to $CoCl_2(C_5H_5N)_2(CHCl_3)_2$. O. D. S.

Infra-red absorption spectra and modes of vibration of thiosulphates. Modes of vibration of the SO_3 group in these salts and in some other metallic salts. (Mme.) R. Duval and J. Lecomte (*Compt. rend.*, 1941, **213**, 998—1000).—There are 4 principal regions of absorption. The SO_3 ion possesses a pyramidal structure, the angle at the apex being 125—145°. A. J. M.

Ultra-violet absorption spectra by reflexion of solid metallic oxalates. A. Berton (*Compt. rend.*, 1941, **213**, 1001—1003).—Many metallic oxalates have an absorption band at 2500—4000 cm.$^{-1}$, the max. of which varies with the metal, but lies between 2600 and 2450 A. This corresponds to the two CO_2 groups. $H_2C_2O_4$ itself has an absorption band towards longer λ. For a certain no. of oxalates a series of narrow bands is observed at regular intervals ~1500 cm.$^{-1}$ They are not found with aq. solutions of oxalates. H_2O of crystallisation displaces the bands towards longer λ by 50—100 A. H oxalates give a wide band similar to that of $H_2C_2O_4$. Double oxalates have different absorption spectra from the normal salts, probably due to formation of complex ions. A. J. M.

Approximate calculation of the fundamental frequencies of vibration of branched-chain saturated aliphatic hydrocarbons. M. Parodi (*Compt. rend.*, 1941, **213**, 1005—1007).—A method of calculating the fundamental ν of some of the plane vibrations of a mol. of the type $Pr^{\beta}\cdot[CH_2]_n\cdot Me$ is given. It gives reasonable agreement with experiment when applied to *iso*-C_5H_{12}, -C_6H_{14}, and -C_8H_{18}. A. J. M.

Ultra-violet absorption spectrum of coronene. J. W. Patterson (*J. Amer. Chem. Soc.*, 1942, **64**, 1485—1486).—Positions and intensities of absorption bands between 2500 and 5000 A. are tabulated and plotted. W. R. A.

Association effects in the Raman spectra of solutions of thiophenol in donor solvents. R. H. Saunders, M. J. Murray, and F. F. Cleveland (*J. Amer. Chem. Soc.*, 1942, **64**, 1230—1231).—Raman spectra of PhSH and its solutions in C_6H_6, C_6H_5N, Pr^{β}_2O, $COBu^{\beta}_2$, $NH(CH_2Ph)_2$, and dioxan have been investigated. No modification in the no. or position of lines has been found except with dioxan, which exhibits two SH $\nu\nu$, the new one at 2536 cm.$^{-1}$ being weak and broad. W. R. A.

Raman spectra of aromatic carbonyl and nitro-compounds. M. J. Murray, F. F. Cleveland, and R. H. Saunders (*J. Amer. Chem. Soc.*, 1942, **42**, 1181—1184).—Raman $\nu\nu$, intensities, and depolarisation factors are given for COPhMe, mesitaldehyde, acetylmesitylene, 2 : 4 : 6 : 1-$C_6H_2Me_3\cdot CO_2Me$ and -$C_6H_2Me_3\cdot COCl$, and $\nu\nu$ and intensities for acetyldurene and nitromesitylene. W. R. A.

Infra-red and Raman spectra of some alkyl nitrates; molecular structure and mode of vibration. J. Lecomte and J. P. Mathieu (*Compt. rend.*, 1941, **213**, 721—723).—The infra-red and Raman spectra of $MeO\cdot NO_2$ have been redetermined and the results are discussed in connexion with the spectra of Et, Pr, and Bu nitrates. J. L. E.

Application of the new analysis of molecular spectra to some interesting molecules. Biological chemicals. H. Deslandres (*Compt. rend.*, 1941, **213**, 749—753; cf. A., 1940, I, 55).—The analysis previously described is applied to Raman $\nu\nu$ for CO, CO_2, CH_2O, glycollic acid, glycerol, and cholesterol. N. M. B.

Application of the new analysis of molecular spectra to some interesting molecules. Biochemical substances. H. Deslandres (*Compt. rend.*, 1941, **213**, 957—961).—An analysis of the infra-red frequencies of HCN, $CO(NH_2)_2$, pyrrole, glycine, and tyrosine is given and discussed. A. J. M.

Classification of Raman frequencies according to crystalline system. J. Barriol (*Compt. rend.*, 1941, **213**, 734—736).—Cryst. systems are classified into six groups which give characteristic Raman spectra. J. L. E.

Fluorescent lamp as voltage stabiliser.—See A., 1942, I, 281.

Dispersion of the dielectric constant of the alums. R. Guillien (*Compt. rend.*, 1941, **213**, 991—993).—The dispersion of the dielectric const. ϵ, of Fe NH_4, Cr NH_4, Al NH_4, and Al K alums is investigated at $\nu\nu$ up to $1{\cdot}36 \times 10^7$. Electrical absorption ϵ' is measured at $\nu\nu$ 50—$1{\cdot}36 \times 10^7$. The temp. at which ϵ and ϵ' are max. are the lower the lower is ν. At const. temp. ϵ decreases with increasing ν, the curve being S-shaped. ϵ' reaches a max. for a certain ν. A. J. M.

Dielectric behaviour, supercooling, and vitrification of chlorobutanes and chloropentanes. A. Turkevich and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 737—745).—Dielectric consts. and sp. conductances of Bu$^\beta$Cl, *iso*- and *tert*.-$C_5H_{11}Cl$, and $CH_2Cl{\cdot}CClMe_2$ (**I**) have been measured at various frequencies over a wide range of temp. and the behaviour at various temp. has been studied with the polarising microscope. None of them rotates in the cryst. state. Both $C_5H_{11}Cl$ show supercooling, and Bu$^\beta$Cl and (**I**) vitrify. The solid transition of EtBu$^\gamma$ is enantiotropic, the high-temp. form being isotropic and the low-temp. form anisotropic. Irregularity of mol. form and possible co-existence of two more mol. shapes appear to cause a tendency to vitrification, which is greatly affected by a small difference in the size of an atom or group in a mol. W. R. A.

Dipole moments and structures of diketen, and of acid anhydrides and related oxygen and sulphur compounds. P. F. Oesper and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 768—771).—Vals. of the dipole moment (μ), in C_6H_6, are given for diketen (**I**), Bz_2O, Ph_2SO_2, Bz_2O_2, and Bz_2S_2. μ for (**I**) does not uniquely distinguish between its probable structures. Cyclic anhydrides have vals. of $\mu >$ those for similar alicyclic anhydrides, and aromatic anhydrides have their moments increased by resonance contributions from highly polar structures. μ for Bz_2O_2 and Bz_2S_2 are $\ll$ for Bz_2O. The high val. for Ph_2SO_2 is consistent with a structure of two tetrahedra sharing an apex. W. R. A.

Reduction of dipole moment by steric hindrance in di*tert*.-butylquinol and its dimethyl ether. P. F. Oesper, C. P. Smyth, and M. S. Kharasch (*J. Amer. Chem. Soc.*, 1942, **64**, 937—940).—The dipole moments of di*tert*.-butylquinol and its Me_2 ether are 1·68 and 1·47 D. The steric repulsion of Bu$^\gamma$ groups restricts the rotational freedom of the OH and OMe groups and reduces the moment. These data and vals. for hydroxy- and methoxy-benzenes suggest that the bond between O and the ring has only small double-bond character. W. R. A.

Dipole moment and resonance in heterocylic molecules containing nitrogen and sulphur. P. F. Oesper, G. L. Lewis, and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 1130—1133).—Vals. for μ in C_6H_6 are given (and discussed) for 2-nitrothiophen, 4 : 5-diphenyl-2-methyloxazole, benzthiazole, 1-thiol-, 1-methylthiol-, 1-thiol-3- and 5-methyl-, and 1-methyl-benzthiazole. W. R. A.

Dipole moment of a free radical. J. Turkevich, P. F. Oesper, and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 1179—1180).—The dipole moments, in C_6H_6, of $\alpha\alpha$-diphenyl-β-picryl-hydrazine (**I**) and -hydrazyl (**II**) have been measured. μ of (**I**) is $\gg \mu$ for phenylhydrazines, indicating resonance with large contributions from polar structures. μ of (**II**) is $> \mu$ of (**I**) owing to increased resonance. No evidence of localisation of the odd electron in (**II**) to form a dipole similar to those associated with bonds could be found. W. R. A.

Mol. refraction–critical temperature nomograph. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 689).—A nomograph is given for org. acids, alcohols, esters, ethers, hydrocarbons, and nitriles. D. F. R.

Elastic relaxation and double refraction of rolled polystyrene. E. Jenckel and F. Nagel (*Kolloid-Z.*, 1941, **97**, 37—46).—The sp. double refraction of rolled plates of polystyrene $\propto$ their deformation, and for a given deformation decreases with rising temp. The rate of elastic relaxation, measured by the shrinkage, increases with rising temp., but less rapidly than the double refraction decreases. For plates rolled at different temp., the rate of relaxation at temp. >90° decreases slightly with decrease of the temp. of rolling between 70° and 40°. The observations are explained by reference to a mechanical model. F. L. U.

Evaluation of functions related to Tait's mean free path. P. Rosenberg (*Physical Rev.*, 1942, [ii], **61**, 528—530).—Tabular data for functions in kinetics and scattering. N. M. B.

Disperse structure of solid systems and its thermodynamic basis. V. D. Balarev (*Kolloid-Z.*, 1941, **97**, 300—304; cf. A., 1935, 445).—Cryst. $BaSO_4$ containing Na_2SO_4, K_2SO_4, Rb_2SO_4, or Cs_2SO_4 as impurities, when washed or shaken with H_2O, yields sols in which the particles are slightly <1 μ. in size. $BaSO_4$ containing $BaCl_2$ behaves similarly, but yields sols with still finer particles. Sol formation continues after washing for many weeks, and is attributed to the slow removal of sol. impurity from the interstices between the elementary crystals of which the visible crystals are built up. Other evidence for the author's theory is summarised. F. L. U.

Organic parachors. V. Constitutive variations of the parachors of a series of normal ketones. (Miss) K. Owen, Q. R. Quayle, and W. J. Clegg (*J. Amer. Chem. Soc.*, 1942, **64**, 1294—1296).—Vals. of γ, ρ, and parachors of the fifteen n-ketones of >11 C have been determined. The parachor val. for C:O is constitutive, and decreases with the size of the attached alkyl groups. W. R. A.

Structures of nitrous oxide and hydrogen azide. V. Schomaker and R. Spurr (*J. Amer. Chem. Soc.*, 1942, **64**, 1184—1187).—The structures of N_2O and NH_3 have been investigated by the electron diffraction method and the ratios of the interat. distances in N_2O and in N_3' are discussed from the viewpoints of Pauling's and Badger's rules. W. R. A.

Electron-micrographs of preparations of fibrous materials. E. Franz, L. Wallner, and E. Schiebold (*Kolloid-Z.*, 1941, **97**, 36—37).—Electron-micrographs of microtome sections of a film of viscose 20 μ. thick show that the bounding surfaces are not even approx. plane, but are deeply corrugated or serrated. The local darkening previously observed in electron-micrographs of viscose films is due to changes produced by the electron bombardment during the exposure. F. L. U.

III.—CRYSTAL STRUCTURE.

Grid-controlled *X*-ray diffraction tube.—See A., 1942, I, 281.

***X*-Ray study of crystal dynamics.** (Mrs.) K. Lonsdale (*Proc. Physical Soc.*, 1942, **54**, 314—353).—An historical and critical lecture-survey (followed by a discussion) of experiment and theory. N. M. B.

Secondary *X*-ray spectrum of sylvine. (Sir) W. Bragg (*Proc. Physical Soc.*, 1942, **54**, 354—361).—The co-existence in a crystal of large and small groups of atoms, with loss of continuity in phase relationship, would predict, for KCl, nearly circular diffuse spots at small angles of total deflexion, whereas the Faxén–Waller theory, using known vals. of the elastic consts., predicts diffuse spots in the shape of elongated ellipsoids of max. intensity at the centre. This accords better with observation than the view that the crystal remains a single crystal distorted by the heat waves, but with no loss of continuity. N. M. B.

Lattice dynamics and *X*-ray scattering. M. Born (*Proc. Physical Soc.*, 1942, **54**, 362—376).—Mathematical. A refutation of Raman's criticism of the explanation of the "extra spots" in Laue photographs on a thermal basis. The method of the cyclic lattice in lattice vibrations gives a solution agreeing with the rigorous dynamical solution. The "extra spots" are due to acoustical, and not to optical, branches. N. M. B.

Crystal structure of Cu_3N. R. Juza (*Z. anorg. Chem.*, 1941, **248**, 118—120).—Cu_3N is anti-isomorphous with ReO_3, DO_3 type. F. J. G.

***X*-Ray investigations on magnesium amalgams. I.** G. Brauer and R. Rudolf (*Z. anorg. Chem.*, 1941, **248**, 405—424).—Powder photographs of Mg amalgams indicate the existence of the following phases: α, solid solutions of Hg in Mg; β, Mg_3Hg; γ, Mg_5Hg_2; δ, Mg_2Hg; ε, Mg_5Hg_3; ζ, MgHg; and η, $MgHg_2$. β is hexagonal, with a 4·858, c 8·639 A., ρ 5·16, and two mols. in the unit cell. ε is hexagonal with a 8·243, c 5·919 A., ρ 7·02, and two mols. in the unit cell. η is in equilibrium with liquid at room temp. It is tetragonal with a 3·830, c 8·781 A., ρ 10·92, two mols. in the unit cell, $MoSi_2$ type; at. positions are given. F. J. G.

Structure of complex fluorides. Potassium oxyhexafluoniobate, K_3NbOF_6. M. B. Williams and J. L. Hoard (*J. Amer. Chem. Soc.*, 1942, **64**, 1139—1141).—*X*-Ray photographs of K_3NbOF_6 show holohedral symmetry, a face-centred unit, a 8·87 A., containing 4 stoicheiometric mols., and the crystals are aggregates of $K^\cdot$ and $NbOF_6'''$ with some randomness. The $NbOF_6'''$ and ZrF_7'''' ions are of the same structural type and quite different from NbF_7'' ions. W. R. A.

Structures of complex fluorides. Rubidium hexafluogermanate. W. B. Vincent and J. L. Hoard (*J. Amer. Chem. Soc.*, 1942, **64**,

1233—1234).—New *X*-ray data on Rb_2GeF_6, in contradiction to earlier results (A., 1939, 1, 600), indicate that Rb_2GeF_6 is isomorphous with $(NH_4)_2GeF_6$ and K_2GeF_6, has a 5·82, c 4·79 A., and space-group D_{3d}^3—$C\bar{3}m$, and is an aggregate of Rb· and practically regular octahedral GeF_6'' ions. W. R. A.

X-Ray investigation of calcium bismuth oxychlorides and oxybromides. L. G. Sillén and (Miss) A. S. Gjörling-Husberg (*Z. anorg. Chem.*, 1941, **248**, 121—134).—A no. of tetragonal phases having layer lattices occur in the systems Ca–Bi–O–Cl and Ca–Bi–O–Br. $Ca_{2-3x}Bi_{1+2x}O_2Cl_3$ ($x \sim 0{\cdot}25$) has a 3·897, c 21·69 A.; at. positions and interat. distances are given. $Ca_{2-3x}Bi_{3+2x}O_4Cl_5$ (x undetermined) has a 3·889, c 36·38 A; at. positions are given. $CaBi_2O_3Br_2$ has a 3·915, c ~20·7 A; at. positions are given. Another tetragonal Ca Bi oxybromide has a 3·91, c 28·8 A.; structure and composition undetermined. F. J. G.

Compounds $BaBiO_2Cl$ and $BaBiO_2Br$. L. G. Sillén and (Miss) A. S. Gjörling-Husberg (*Z. anorg. Chem.*, 1941, **248**, 135—136).—*$BaBiO_2Cl$* is of type D_{4h}^{17}—$I4/mmm$, with a 4·019, c 12·98 A. *$BaBiO_2Br$* has the same structure with a 4·080, c 13·27 A. At. positions and interat. distances are given. F. J. G.

Recent results in starch investigation. IV. *X*-Ray diffraction patterns of starches. M. Samec and M. Blinc (*Kolloid Beih.*, 1940, **52**, 57—86).—A review of the literature under the following headings: fundamental structure, patterns of different starches, effect of drying, effect of gelatinisation, changes in patterns due to ageing, patterns of starch degradation products, patterns of bread, patterns of nitrostarches, and ice-lines in the *X*-ray patterns of starches. N. G.

Deformation mechanism and fine structure of regenerated cellulose. XVIII. Limitations and comparison of qualitative methods of determining the degree of orientation of stretched cellulose fibres. P. H. Hermans. **XIX. Derivation of an "average angle of orientation" from *X*-ray diagrams.** J. de Booys and P. H. Hermans (*Kolloid-Z.*, 1941, **97**, 223—228, 229—231).—XVIII. Discussion. XIX. Theoretical. C. R. H.

Crystal structure of β-isoprene sulphone. E. G. Cox and G. A. Jeffrey (*Trans. Faraday Soc.*, 1942, **38**, 241—247).—Detailed *X*-ray analysis shows the mol. of β-isoprene sulphone to have a heterocyclic structure in which resonance occurs between the three C–C bonds of the C_4S ring. The bond lengths are: C—C (ring) 1·41, C (ring)—C(Me) 1·54, C—S 1·75, S—P 1·44 A., all ±0·02 A. The distribution of the four S bonds is approx. tetrahedral. F. L. U.

Subsidiary maxima in electron diffraction and *X*-ray diffraction patterns from single crystals. A. Charlesby (*Proc. Physical Soc.*, 1942, **54**, 379—387).—A qual. comparison of the Faxén–Waller theory with the explanation of diffuse bands in electron diffraction shows that the non-appearance of the latter in *X*-ray diffraction is due to differences in λ, intensity, crystal size, etc. N. M. B.

Examination of electrolytically produced and annealed films of aluminium oxide by electron diffraction and in the electron microscope. G. Hass and H. Kehler (*Kolloid-Z.*, 1941, **97**, 27—35).—The Al_2O_3 films described previously (A., 1942, I, 250) remain amorphous when heated for 1 hr. at 650°, but at 700—900° they break down and become cryst., with a lattice const. (face-centred cubic) of 8·06 A. No conversion into α-Al_2O_3 at 900° could be detected, but such conversion is observed after intense bombardment with fast electrons. F. L. U.

Disperse structure of solid systems. II. D. Balarev (*Kolloid Beih.*, 1940, **52**, 45—56; cf. A., 1939, I, 369).—Polemical, largely against Kossel's theory of crystal growth. A. J. E. W.

Orientation of liquid crystals by rubbed surfaces. P. Chatelain (*Compt. rend.*, 1941, **213**, 875—876).—When azoxyanisole is placed between surfaces rubbed in a given direction, the mols. are oriented in the plane of the normal to the surface and the direction of rubbing, but the orientation gradually changes. The effect is observed with the nematic state, but not with the smectic state. A. J. M.

Plasticity of ice. F. Höppler (*Kolloid-Z.*, 1941, **97**, 154—160).—Flow curves of ice at varying shearing stresses show that the quasi-η increases from $1{\cdot}72 \times 10^{11}$ to $2{\cdot}13 \times 10^{15}$ centipoises as the temp. decreases from −1° to −30°. C. R. H.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Paramagnetism of hydrated calcium ferrites. (Mlle.) J. Foret (*Compt. rend.*, 1941, **213**, 525—526).—The paramagnetism of the Fe oxide in the ferrite is independent of the decomp. and colour change of the ferrite, and shows no appreciable relation to the [NaOH] used in the pptn. of the ferrite. N. M. B.

Configuration of complex kojates formed with transition elements as determined by magnetic susceptibility measurements. J. W. Wiley, G. N. Tyson, jun., and J. S. Steller (*J. Amer. Chem. Soc.*, 1942, **64**, 963—964).—Complex *kojates* of Cu^{II}, Co^{III}, Ni^{III}, Fe^{II}, and Mn^{II} have been synthesised; from χ determinations the Cu complex is either tetrahedral or planar, whilst the others are tetrahedral. The first three compounds are $+0{\cdot}5H_2O$; the other two are anhyd. W. R. A.

Supersonic absorption and Stokes' viscosity relation. L. Tisza (*Physical Rev.*, 1942, [ii], **61**, 531—536). N. M. B.

Raman's theory of the specific heat of solids. M. Blackman (*Proc. Physical Soc.*, 1942, **54**, 377—379).—Raman's rejection of the Debye and lattice theory is critically examined; the lattice theory gives better agreement with experiment. N. M. B.

Heat capacity and vapour pressure hysteresis in liquid *iso*pentane. Isomerides due to hindered rotation. J. G. Aston and S. C. Schumann (*J. Amer. Chem. Soc.*, 1942, **64**, 1034—1038).—In the region 180° to 240° K. C_p and v.p. data show hysteresis effects to ~100 times the precision of measurements, possibly on account of a slow transformation into an isomeric form as a result of restricted rotation. W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and vapour pressure of *iso*pentane. S. C. Schumann, J. G. Aston, and M. Sagenkahn (*J. Amer. Chem. Soc.*, 1942, **64**, 1039—1043).—Vals. of C_p from 12° to 290° K. have been measured calorimetrically; v.p. measurements accord with $\log P_{mm.} = -9170{\cdot}850/T - 194{\cdot}4680 \times \log T + 0{\cdot}3108920T - 1{\cdot}936031 \times 10^{-4}T^2 - 439{\cdot}3143$; m.p. 113·39° ±0·05° K.; b.p. 300·90° ±0·05° K.; heats of fusion and vaporisation, 1226·3±0·5 and 5878 ±5 g.-cal. per mol.; entropies from thermal and spectroscopic data for the ideal gas at 298·16° K. and 1 atm. are 82·01±0·55 and 73·180 g.-cal. per degree per mol. The potential of the torsional motion between Et and Pr^β groups is calc. and free energies of formation of *n*-, *iso*-, and neo-pentane are derived from these and recorded data. W. R. A.

Heat capacity of organic vapours. III. Nitromethane. T. D. Vries and B. T. Collins (*J. Amer. Chem. Soc.*, 1942, **64**, 1224—1225).—Data confirm those of Pitzer and Gwinn (A., 1942, I, 138). W. R. A.

Heat of fusion and heat capacities of solid and liquid white phosphorus. F. E. Young and J. H. Hildebrand (*J. Amer. Chem. Soc.*, 1942, **64**, 839—840).—From 0° to 44·2°, C_p of solid white P_4 is given by $C_p = 21{\cdot}46 + 2{\cdot}872 \times 10^{-2}\theta$. For liquid P_4 in the range 25—97° $C_p = 24{\cdot}47 - 9{\cdot}521 \times 10^{-3}\theta - 3{\cdot}927 \times 10^{-5}\theta^2$. At the m.p., 44·2°, the heat of fusion is 601 g.-cal. per mol. W. R. A.

Phase equilibria in hydrocarbon systems. Thermodynamic properties of *n*-pentane. B. H. Sage and W. N. Lacey (*Ind. Eng. Chem.*, 1942, **34**, 730—737).—The sp. vol. and v.p. of n-C_5H_{12} are determined between 100° and 460° F. and up to 10^4 lb. per sq. in. The volumetric behaviour in the crit. region is studied in detail. Enthalpy–pressure coeffs. in the liquid and gaseous regions, and vals. of the isothermal enthalpy changes and of the fugacity of n-C_5H_{12}, are calc. D. F. R.

Viscosity of gases and vapours and their measurement in the Höppler viscometer. R. Wobser and F. Müller (*Kolloid Beih.*, 1941, **52**, 165—276).—A Höppler viscometer (A., 1933, 367) of variable angle allows measurement, accurate to 0·1—0·15%, of η up to 10^3 poises of liquids or gases at pressures <250 mm. and temp. from 0° to 100°. η of air, by comparison with liquid H_2O, is 1815×10^{-7} poise at 20°, agreeing with the vals. of Shiba (A., 1932, 1187), Houston (A., 1938, I, 22), and Rigden (*ibid.*, 131, 393). The Sutherland const. C of air between 20° and 100° is 113. The following vals. of η at 20° (in poises $\times 10^{-7}$) and C (in that order) were also obtained; O_2, 2030, 127; N_2 1751, 104; H_2 879·3, 66·8; Cl_2 1333, 345; A 2228, 148; He 1956, 72·9; Ne 3118, 64·1; NH_3 986·6, 505; CO_2 1465, 253; CO 1753, 102; SO_2 1254, 404; NO 1882, 133; N_2O 1462, 263; C_2H_2 997·7, 320; CH_4 1093, 169; C_3H_8 802·9, 288; n-C_4H_{10} 734·3, 309. Vals. of n in the equation $\eta_2/\eta_1 = (\theta_2/\theta_1)^n$ are tabulated and lie between 1·1 and 0·6 for the θ range 20° to 100°. O. D. S.

Correlation between elastic moduli and viscosity of liquids and plastics. A. Gemant (*J. Appl. Physics*, 1941, **12**, 680—685).—An equation connecting elastic moduli (bulk and Young's) of liquids and plastics with their η is deduced. The equation is applicable to a pure substance, or to chemically related substances. The equation is applied to simple hydrocarbons, petroleum fractions, polyvinyl plastics, and glasses. A. J. M.

Theory of fusion. J. G. Kirkwood and (Miss) E. M. Boggs (*J. Chem. Physics*, 1942, **10**, 307).—The distribution function used (cf. Kirkwood and Monroe, A., 1941, I, 400) can represent a non-uniform density distribution with the period of a specified space lattice provided the position and orientation of the crystal are fixed by external forces. L. J. J.

Structure and dynamics of liquids. W. E. Roseveare, R. E. Powell, and H. Eyring (*J. Appl. Physics*, 1941, **12**, 669—679).—A liquid may be regarded as a solid to which a large no. of empty equilibrium positions are added. Expansion on melting and on heating arises almost entirely from the presence of new equilibrium positions. Consideration of fluidity and of the theory of melting gives information concerning the no., size, and energy of formation of these empty lattice points. A. J. M.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Statistical mechanics of binary mixtures. T. Alfrey and H. Mark (*J. Chem. Physics*, 1942, **10**, 303—304).—The configurational partition function is derived by specification of occupants of a set of lattice point pairs. L. J. J.

Interconversions of binary compositions by simple graphical methods. K. H. Sun and A. Silverman (*Ind. Eng. Chem.*, 1942, **34**, 682—684).—Two methods are given for the interconversion of wt., vol., and mol. fractions, and for conversion into these fractions from compositions expressed in parts by wt., or otherwise, in a binary system. D. F. R.

Structure mechanics of viscous-elastic continua. V. Viscosity and mol. wt. H. Umstätter (*Kolloid-Z.*, 1941, **97**, 53—61; cf. A., 1940, I, 203).—An expression for the temp.-variation of η of a liquid, formally similar to the Clapeyron v.p. equation, is deduced, its validity being restricted to temp. in the neighbourhood of half the abs. crit. temp. ($\frac{1}{2}T_c$) of the liquid. For liquids in which the internal friction appears wholly as heat, the mol. wts. of different liquids $\propto (\frac{1}{2}T_c)^2$ when their internal pressures and the vals. of $d\eta/dT$ are the same. This is also true for solutions so dil. that the internal pressure of the solvent remains substantially unchanged, so that by determining the val. of $\frac{1}{2}T_c$ for the solution its mean mol. wt., and hence the mol. wt. of the solute, can be calc. A simple graphical method of obtaining T_c vals. is explained. Since the temp. differences involved are several times as great as those measured in the ebullioscopic and cryoscopic methods mol. wts. can be determined from η measurements with the same accuracy by the use of an ordinary thermometer. The method has not yet been extended to colloidal solutions, but gives good results with hydrocarbons of mol. wts. 280—440 dissolved in C_6H_6. F. L. U.

Molal volumes of solutes. VI. Potassium chlorate and hydrochloric acid. O. Redlich and J. Bigeleisen. **VII. Sodium acetate and acetic acid.** O. Redlich and L. E. Nielsen (*J. Amer. Chem. Soc.*, 1942, **64**, 758—760, 761—762).—**VI.** The limiting law of the molal vol. has been confirmed by the determination of ρ of aq. $KClO_3$ and HCl with a precision of $\sim 4 \times 10^{-7}$ at high dilution. These substances do not exhibit any anomaly.

VII. The apparent molal vols. of aq. NaOAc and AcOH at 25·00° required for a test of Born's equation have been determined with an estimated uncertainty of 0·03 and 0·01 c.c. per mol., respectively. W. R. A.

B.p.–composition data for the methyl alcohol–dioxan system. F. L. Padgitt, E. S. Amis, and D. W. Hughes (*J. Amer. Chem. Soc.*, 1942, **64**, 1231—1232).—The b.p.–composition curves for liquid and vapour phases have been determined. W. R. A.

Vapour pressures of aqueous solutions at high temperatures. N. B. Keevil (*J. Amer. Chem. Soc.*, 1942, **64**, 841—850).—V.p. data between 150° and 650° are given for saturated aq. solutions of NaCl, NaBr, NaI, KCl, KI, Na_2CO_3, Na_2SO_4, $Ca(NO_3)_2$, and a mixture of KCl and NaBr. Crit. conditions near the crit. point of H_2O have been confirmed for Na_2CO_3 and Na_2SO_4. Continuous curves are given by very sol. salts showing max. v.p. at temp. between the triple points of H_2O and of salt and no crit. region. Max. v.p. is the less the greater is the initial temp. coeff. of solubility and the lower is the m.p. of the salt. W. R. A.

Temperature and composition coefficients of the density, refractive index, and viscosity of the methyl alcohol–dioxan system. E. S. Amis, A. R. Choppin, and F. L. Padgitt (*J. Amer. Chem. Soc.*, 1942, **64**, 1207—1212).—Vals. of ρ, n, and η of MeOH, dioxan, and their mixtures have been measured at various temp. and composition and temp. coeff. equations have been derived. W. R. A.

Influence of solvation on the viscosity of solutions. Paraffin derivatives. W. Philippoff and K. Hess (*Kolloid-Z.*, 1941, **97**, 170—176).—η_{20} data for aq. EtOH, AcOH, and dioxan solutions of RMe, RCO_2H, RCO_2Na, RCO_2K, RCO_2Tl, RC_5H_5NCl, NMe_3RBr, and $NaRSO_4$ ($R = n\text{-}C_{11}H_{23}$) are applied to a discussion of the influences of chain length, presence of active groups, and nature of the solvent on η. C. R. H.

Dielectric polarisation of benzyl alcohol. W. Hückel and U. Wenzke (*Z. physikal. Chem.*, 1942, **B**, **51**, 144—156).—The ϵ and d of various solutions of $CH_2Ph{\cdot}OH$ in *cyclo*hexane, C_6H_6, and CCl_4 have been determined at 0—60° and the dielectric polarisation P of $CH_2Ph{\cdot}OH$ deduced. In *cyclo*hexane P decreases initially with increasing $[CH_2Ph{\cdot}OH]$, then rises to a max. and gradually decreases again. The same behaviour is observed in C_6H_6 at low temp., but at higher temp. the curve changes in form, the val. of P being depressed considerably at low concns. It is suggested that at lower temp. highly dipolar $(CH_2Ph{\cdot}OH)_3$ aggregates are present, but that at higher temp. and low concns. the non-dipolar $(CH_2Ph{\cdot}OH)_2$ mols. predominate. J. W. S.

Electric moments of organomercuric halides in dioxan. B. C. Curran (*J. Amer. Chem. Soc.*, 1942, **64**, 830—833).—The electric moments of Hg Ph, *p*-C_6H_4Me, *p*-C_6H_4Cl, Bu, and C_5H_{11} bromides in dioxan and of $C_5H_{11}{\cdot}HgCl$ in dioxan and in C_6H_6 have been measured and results show that the mols. are non-linear, that the C(phenyl)–Hg bond has practically no double bond character, that co-ordinate bonds are not formed between solvent and halide, and that dipole–dipole bonds exist between O and Hg in dioxan. W. R. A.

Determination of molecular and ionic weights of dissolved substanes by methods of dialysis and free diffusion. II. G. Jander and H. Spandau (*Z. physikal. Chem.*, 1940, **A**, **187**, 13—26; cf. A., 1940, I, 204).—"Cellafilters" with mean pore radius ~500 A. are suitable for the dialysis method up to particle wts. ~5000. Within this range the dialysis coeffs. (λ) obtained are $\propto$ diffusion coeffs. obtained by free diffusion, and $\lambda\eta$ is const. for a given diffusing particle. The latter relation enables λ vals. for different substances in different foreign electrolyte solutions to be correlated. L. J. J.

Anomalous mixed crystals and oriented crystallisation. A. Neuhaus (*Angew. Chem.*, 1941, **54**, 527—536).—Review. A. J. E. W.

F.p. of binary mixtures of diphenylamine and other organic compounds. O. A. Nelson and L. E. Smith (*J. Amer. Chem. Soc.*, 1942, **64**, 1057—1059).—Crystallisation temp., eutectic composition and temp. have been determined for $NHPh_2$ with phenoxathiin, *p*-nitrophenetole, $1\text{-}C_{10}H_7{\cdot}NO_2$, dibenzfuran, and phenothiazine. F.p. consts. have been calc. W. R. A.

Ferrous sulphide mixed crystals. H. Haraldsen (*Z. anorg. Chem.*, 1941, **246**, 169—194).—The system FeS–S has been studied in the region 50—55 total at.-% S by *X*-ray, density, and magnetic methods. With 50—51 at.-% S an overstructure region exists which at higher [S] passes into a matrix *B*.8 structure which is stable up to 53·4 at.-% S, after which the pyrites lattice is developed, with a rapid decrease in mol. vol. At the transition point between the overstructure and *B*.8 structure regions the paramagnetism changes only slightly but discontinuously. The behaviour can be explained by assuming that besides the at. linkings with antiparallel spin in the direction of the *c* axis, similar linkings also occur in the direction of the *a* axis but are broken in the transition from the overstructure to *B*.8 structure. Transition from antiferromagnetism to ferromagnetism occurs with >52·2 at.-% S, and the susceptibility becomes a max. at ~53·4 at.-% S where the no. of vacant positions in the pyrites lattice is a max. J. W. S.

***X*-Ray study of the calcium–strontium alloy series.** A. J. King (*J. Amer. Chem. Soc.*, 1942, **64**, 1226—1227).—Ca–Sr alloys have been analysed by an *X*-ray diffraction method. All crystallise with a face-centred cubic lattice, the a_0 of which increases with Sr content. Thus Ca and Sr form a continuous series of solid solutions at room temp. W. R. A.

Behaviour of the alkaline earth metals to one another. W. Klemm and G. Mika (*Z. anorg. Chem.*, 1941, **248**, 155—166).—*X*-Ray investigation shows that Ca and Sr form a complete series of mixed crystals, whereas the systems Ca–Ba and Sr–Ba each show two series of mixed crystals separated by a two-phase region. F. J. G.

Thermodynamic study of the tin–bismuth system. H. Seltz and F. J. Dunkerley (*J. Amer. Chem. Soc.*, 1942, **64**, 1392—1395).—The activities and relative heat contents of Sn and Bi in their liquid alloys have been found from e.m.f. measurements. The β solid solution at the eutectic point contains 20% of Bi whilst the α solid solution contains 2·4% of Sn. Endo's curve (B., 1926, 327) appears to be too low, but the α liquidus points obtained by Würschmidt (A., 1921, ii, 646) are in good agreement with those calc. from presented data. W. R. A.

Liquid–liquid extraction data. Toluene and acetaldehyde systems. D. F. Othmer and P. E. Tobias (*Ind. Eng. Chem.*, 1942, **34**, 690—692).—Solubility data are given for the separation of PhMe from excess of C_7 aliphatic hydrocarbons (*e.g.*, $n\text{-}C_7H_{16}$) using 97—98% AcOH, and of MeCHO from H_2O using PhMe, C_6H_6, $n\text{-}C_6H_{11}{\cdot}OH$, or furfuraldehyde. A graphical method is given for applying the lever rule in locating tie lines in ternary solubility diagrams. D. F. R.

Recovery of nitrous gases by adsorption. IV. Heat of adsorption of nitric oxide by silica gel. E. Briner and B. Sguaitamatti (*Helv. Chem. Acta*, 1942, **25**, 370—375).—The heat of adsorption (q) of NO on SiO_2 gel at room temp., measured calorimetrically, varies from −5800 to −6600 g.-cal. per g.-mol., according to the degree of desiccation of the gel, suggesting that no chemical reaction occurs. Calculation of q from the adsorption isotherm leads to vals. nearest in accord with observation if it is assumed that the adsorption comprises condensation rather than assimilation of the gas. J. W. S.

Dielectric properties of a substance in the sorbed state. I. Higuti (*Bull. Inst. Phys. Chem. Res. Japan*, 1941, **20**, 489—513).—The dielectric const., ϵ, of $Pr^{\alpha}OH$ sorbed by TiO_2 gel was measured between 70° and −70°. Vals. of ϵ in the adsorbed state and in the state of capillary condensation from −60° to 40° are calc.;

vals. of ϵ for the former are < those for the latter, and both are < those for the bulk liquid, the differences increasing with fall of temp. D. F. R.

Adsorption of hydroxybenzenes by fuller's earth. W. Bielenberg and H. Goldhahn (*Kolloid-Z.*, 1941, **97**, 151—153).—Data for the adsorption of mono-, di-, and tri-hydroxybenzenes show that adsorption increases in this order. C. R, H.

Ionic adsorption in solutions of silica and alumina. P. G. Nutting (*J. Washington Acad. Sci.*, 1942, **32**, 117—122).—The initial decrease in p_H on adding 0·1% aq. KOH to SiO_2 (1·5 units for solutions of 1—100 mg. per 100 c.c.) and to Al_2O_3 (up to 5 units for solutions of 0·01—10 mg. per 100 c.c.), and the initial increase in p_H on adding 0·1% aq. HCl to K_2SiO_3 and $KAlO_2$ solutions, is attributed to selective ionic adsorption. E. R. R.

Application of the Gibbs adsorption equation to solutions of colloidal electrolytes. A. E. Alexander (*Trans. Faraday Soc.*, 1942, **38**, 248—254).—In a discussion of discrepancies between the surface adsorption observed in solutions of colloidal electrolytes (paraffin-chain salts, dyes) and that calc. from the Gibbs equation, it is shown that the condition of $d\gamma/dC = 0$ does not necessarily imply that the total adsorption = 0, since this condition might be due to the concn. of single mols. (c_s) becoming approx. independent of the total concn. C. Application of the law of mass action indicates that c_s becomes sensibly const. when once aggregation has set in, hence, since the adsorption should be calc. from the relation of γ to c_s rather than to C, there is no anomaly. This explanation may also hold for apparent anomalies in non-aq. solutions (cf. McBain and Perry, A., 1940, I, 252), but cannot be applied to some results with dyes, which may show no adsorption experimentally when $d\gamma/dC = 0$. F. L. U.

Surface diffusion of carbon dioxide in activated carbon. E. Wicke and R. Kallenbach (*Kolloid-Z.*, 1941, **97**, 135—151).—Data obtained for the diffusion of CO_2 through activated C, clay, and fritted glass over the pressure range 760—100 mm. at 0° and over the temp. range 0—200° at 760 mm. are presented and discussed. C. R. H.

Superliquid in two dimensions and first-order change in condensed monolayer. I. Energy, compressibility, and order of phase transformations. W. D. Harkins and L. E. Copeland (*J. Chem. Physics*, 1942, **10**, 272—286).—Monolayers of *n*-paraffin long-chain alcohols show an apparently first-order (Ehrenfest's terminology) transition from an L_2 ("liquid condensed," Adam) to an S (solid) phase. The first-order character in the case of $C_{18}H_{37}\cdot OH$ is confined to the temp. range 7·5—11°; outside this range the transition is second-order. The S phase exists only below 7·5°; above this temp. the stable high-pressure phase is of a new type (LS). The LS phase has low compressibility like S, but is ~10 times more fluid than L_2 at low pressures. Compressibility, energy and entropy of expansion data are recorded. Very large vals. are found for the last, *e.g.*, for n-$C_{18}H_{37}\cdot OH$ $\Delta S = 5{\cdot}86$ ergs per cm. per degree per cm.^{2} expansion at pressure 18 dynes per cm., temp. 8·06°, and mol. area 19·96 A.^{2} The properties of the highly condensed monolayers concerned change very rapidly with mol. area. L. J. J.

Energy relations of the surface of solids. I. Surface energy of the diamond. W. D. Harkins (*J. Chem. Physics*, 1942, **10**, 268—272).—Total and free surface energies (at 25°) for the (111) and (100) faces, calc. from the C–C bond energy val. 90 kg.-cal. per mol., are 5650 and 5400, and 9820 and 9400 ergs per sq. cm., respectively. The effect of long-range interaction is small. L. J. J.

Determination of foaming capacity, and consideration of the average life period (τ) as a characteristic. K. Hoffmann and H. Peter (*Kolloid-Z.*, 1941, **97**, 161—170).—Air is forced through capillaries under the surface of the liquid contained in a narrow tube, the height of the column of foam being a measure of foaming capacity. The average life period (τ) of a foam is defined and the influence of temp. and bubble size on τ is discussed. C. R. H.

Emulsifying power of α-amino-acids. J. Loiseleur (*Compt. rend.*, 1941, **213**, 351—353).—The emulsifying powers of α-NH_2-acids for paraffin (m.p. 70°) have been determined. All acids with a non-polar chain permit the production of stable emulsions, the emulsifying power being the greater the longer is the chain and being particularly high for $CH_2Ph\cdot CH(NH_2)\cdot CO_2H$. When the chain ends in a polar group, however, the acid has no emulsifying power. The emulsions produced are very stable independently of the p_H and salinity of the medium. The observations support the view that in a protein mol. the NH_2-acid groupings are arranged in a manner conditioned by the polar or non-polar character of their chains and also suggest that NH_2-acids cause emulsification of fatty materials in the intestine. J. W. S.

Emulsifying power of proteins. J. Loiseleur and J. J. Lamarca (*Compt. rend.*, 1941, **213**, 568—570).—An emulsion is prepared as follows: 0·1 g. of paraffin (m.p. 70°) is dissolved in 50 c.c. of hot EtOH, and 5 c.c. of 0·2% ovalbumin (I) [prepared by dissolving the (I) in anhyd. HCO_2H and diluting the 10% solution with MeOH] are added; the mixture is poured slowly, with vigorous stirring, into 50 c.c. of boiling H_2O. Some paraffin remains undispersed unless the EtOH–MeOH solution is boiled for ~1 hr. before addition to H_2O. Emulsification is attributed to scission of the (I) mols. and presentation of polar and apolar faces to the respective phases. Casein, edestin, and zein give similar emulsions. The emulsions are purifiable by dialysis and very stable at p_H removed from the isoelectric point of the protein. A. J. E. W.

Mechanics of flow with non-colloidal inert solids in suspension.—See B., 1942, I, 323.

Air-driven ultracentrifuges. G. Schramm (*Kolloid-Z.*, 1941, **97**, 106—115).—A review. F. L. U.

Longitudinal depolarisation of light in suspensions of crystalline particles and colloidal suspensions. S. Procopiu (*Kolloid-Z.*, 1941, **97**, 1—27).—Previous work by the author and others (cf. A., 1933, 553; 1935, 1054; 1939, I, 368, 416) is reviewed and discussed. F. L. U.

Sediment volumes and specific viscosity of suspensions and solutions in mixed liquids. E. W. J. Mardles (*Trans. Faraday Soc.*, 1942, **38**, 222—227; cf. A., 1941, I, 40, 297).—On the basis of experiments with cellulose esters, resins, and various powders dispersed or suspended in mixed liquids ($COMe_2$–H_2O, *cyclo*hexanone–$CH_2Ph\cdot OH$, EtOH–$COMe_2$–C_6H_6, PhOH–NH_2Ph–$COMe_2$) it is shown that variations in the sediment vols. and in the relative η with the composition of the liquid are parallel with the dispersing power of the latter. F. L. U.

Viscosity and structure of hydrophilic colloids. I. C. Rossi (*Kolloid-Z.*, 1941, **97**, 129—135).—η data for bentonite suspensions show that frictional hysteresis occurs, especially at low concns. η depends on velocity, and const. η is attained only if the velocity is kept const. for a sufficient time. C. R. H.

Colloidal thermoscope. II. R. E. Liesegang (*Kolloid-Z.*, 1941, **97**, 96—99).—Details are given for increasing the sensitivity of the indicator previously described (A., 1928, 835) and further observations on its behaviour are recorded. F. L. U.

Representation of stability of colloidal systems by isochrones. Observations on silicic acid sols. A. Dobrowsky (*Kolloid-Z.*, 1941, **97**, 80—87).—The stability relations of SiO_2 sols are shown in triangular diagrams, using as components Na silicate, H_2O, and acid (HCl, H_2SO_4, H_3PO_4, 2-$C_{10}H_7\cdot SO_3H$, succinic and tartaric acids). Lines joining points of equal stability, expressed as log (gelation time), are termed isochrones. Isochrones of the system studied depict a proportionality between decrease of p_H and change of stability, the isochrones being crowded where the titration curves are steepest. At high concns. 2-$C_{10}H_7SO_3H$ depresses the stability of SiO_2 sol more than do the other acids at the same mol. concn. F. L. U.

Constitution of dilute soap solutions. V. Hydrolysis of sodium decoate. P. Ekwall (*Kolloid-Z.*, 1941, **97**, 71—80).—The changes that occur in Na decoate solutions at 20° with increasing concn. are similar to those observed with Na laurate (A., 1942, I, 99), but the corresponding changes occur at higher concns. Na decoate behaves as a normal 1—1 electrolyte up to 0·021N., between which and 0·04N. double anions are formed. Triple anions occur between 0·043 and 0·055N., and association then increases slowly and reaches a limit at ~0·2N. The results support the author's hydrolysis theory. F. L. U.

Phase transition and elastic behaviour of high polymerides.—See B., 1942, II, 294.

Molecular orientation and some associated properties in macromolecular substances. (A) K. H. Meyer. (B) E. Wöhlisch. (C) F. H. Müller (*Kolloid-Z.*, 1941, **97**, 105—106; cf. A., 1942, I, 143).—Discussion of priority claims. F. L. U.

Viscosity of emulsions of highly-viscous materials as a function of concentration. H. Eilers (*Kolloid-Z.*, 1941, **97**, 313—321).—The viscosity–concn. formula of von Bredée and de Booys (A., 1937, I, 303) agrees better with the experimental results on bitumen emulsions than does that of von Houwink and Klaasens (A., 1937, I, 355), except for very conc. systems when the calc. vals. are too low. Spatial considerations show that the viscosity–concn. curve will approach an asymptote when the vol. fraction (C_v) of the dispersed phase = 0·74; for infinitely small values of C_v the former equation changes to that of Einstein. Further empirical equations are proposed for the systems investigated. N. G.

Sorption curve for isotropic cellulose. Preparation of isotropic cellulose threads. P. H. Hermans (*Kolloid-Z.*, 1941, **97**, 326—328).—Isotropic cellulose fibres (I) were prepared as described previously (A., 1938, I, 80), except that the drying fibres were not loaded; even a small load causes some anisotropy. The absorption isotherm for H_2O at 25° was determined for (I); the results agreed with those of Obermiller (B., 1926, 481) and of Kanamaru and Takoda (A., 1939, I, 418; 1940, I, 255) for viscose. N. G.

Gel structure and swelling. P. H. Hermans (*Kolloid-Z.*, 1941, **97**, 231—237).—Discussion. C. R. H.

Electron-microscopic investigation of the muscle-protein myosin. M. von Ardenne and H. H. Weber (*Kolloid-Z.*, 1941, **97**, 322—325).—Seen under the electron microscope, finely-divided myosin (I) consists of fine threads, which are a few thousand mμ. long and 5—10 mμ. thick. Gaps seen in the threads are probably bridged by links too fine to be seen. These very fine threads and those 5 μ. thick are similar in thickness to single threads of (I), hence both micelle bundles and single micelles can arrange themselves into threads. The relation of this to the general interlinking of micelles is discussed. The irreversible destruction of the double refraction of (I) by urea is accompanied by an irreversible destruction of the thread-like structure. N. G.

Electron microscope observations on collagen. C. E. Hall, M. A. Jakus, and F. O. Schmitt (*J. Amer. Chem. Soc.*, 1942, **64**, 1234).—Collagen fibres from various sources exhibit in the electron microscope cross-striations which extend uniformly across the fibre, the distance between bands being between 522 and 902 A. *X*-Ray diffraction data (cf. A., 1942, I, 231) show a fibre axis periodicity of ~640 A. The concordance between the two sets of data indicates that the periodicity arises from the structure and arrangement of collagen mols. in the fibres. W. R. A.

Electrokinetic behaviour of carborundum. A. J. Ham and W. Hodgson (*Trans. Faraday Soc.*, 1942, **38**, 217—221).—Electro-osmotic measurements with carborundum (I) in presence of 0·01N-Na^+ are recorded. In the p_H range 1·90—11·90 the ζ-potential becomes continuously more negative with increase of p_H, isoelectric point being between 2 and 3. In view of its stability and of the reproducibility of the results (I) is a suitable standard substance for electrokinetic measurements, in which it behaves as a non-conductor. The ζ–p_H curves for (I) and m-$C_6H_4(NO_2)_2$ are similar, and indicate that OH' adsorption is the cause of the negative charge. F. L. U.

Effect of carbamide on the electrophoretic patterns of serum-proteins. D. H. Moore (*J. Amer. Chem. Soc.*, 1942, **64**, 1090—1092).—Electrophoresis of human serum in 2·8M-$CO(NH_2)_2$ at 1·5° indicates numerous components, but this is entirely due to convection currents, the temp. coeff. of *d* of the solution being large at 0—4°. *d*-temp. curves are given for some solutions. R. S. C.

VI.—KINETIC THEORY. THERMODYNAMICS.

Ionic competition in base-exchange reactions. R. H. Bray (*J. Amer. Chem. Soc.*, 1942, **64**, 954—963).—Immediate equilibria between mixtures of exchangeable cations, *e.g.*, in clays, and small amounts of an added cation have been studied and cation-exchange equations have been developed by which the release or adsorption of an individual cation present with complementary cations on the colloid can be calc. The consts. of "ease of release" of cations are Na > K > Mg > Ca > H. The effect of the Al of the silicate lattice on the p_H of the supernatant solution in acid clay is discussed in relation to base-exchange equations. W. R. A.

Dissociation constants of phosphorous acid. Y. Takahashi and N. Yui (*Bull. Inst. Phys. Chem. Res. Japan*, 1941, **20**, 521—528).—The dissociation consts., obtained by titrating with NaOH and measuring the p_H with a glass electrode, are 0·031—0·021 and $1·5 \times 10^{-7}$ in the concn. range 0·04—0·01M. The first const. increased with the acid concn., possibly owing to the formation of an acid polymeride such as $H_6P_2O_6$. D. F. R.

Ionisation constant of benzoic acid in methanol–water mixtures. H. N. Parton and J. Rogers (*Trans. Faraday Soc.*, 1942, **38**, 238—240).—E.m.f. of the cell $H_2|BzOH(m_1)|NaOBz(m_2)|NaCl(m_3)|AgCl|Ag$ were measured at 5° intervals from 15° to 45°, and the ionisation const. (*K*) of BzOH calc. by the method of Harned and Ehlers (cf. A., 1933, 350). Vals. of *K* are tabulated for solutions in 10% and 20% MeOH; at 25° they are respectively 4·10 and $1·90 \times 10^{-5}$. Vals. of $\Delta H°$, $\Delta C_p°$, and $\Delta S°$ are also calc. F. L. U.

Dissociation constants of hydroxylysine. F. W. Klemperer, A. B. Hastings, and D. D. van Slyke (*J. Biol. Chem.*, 1942, **143**, 433—437).—The −log dissociation const. vals. of hydroxylysine, pK'_1, pK'_2, and pK'_3, have been determined as 2·13, 8·62, and 9·67, respectively, at 38°. The vals. in each case are < those for lysine and the data are interpreted as confirming the view that the OH in hydroxylysine is in the δ- or ε-position relative to the CO_2H and the second NH_2 is in the ε- or δ-position. J. W. S.

Electrochemistry of non-aqueous solutions. II. Precision measurements of f.p. and conductivity in anhydrous formic acid. J. Lange (*Z. physikal. Chem.*, 1940, **A, 187**, 27—42; cf. *ibid.*, 1940, **A, 186**, 291).—Osmotic properties of HCO_2H solutions of KCl, NMe_4Cl, K picrate, and methylene-blue hydrochloride (I) have been investigated by f.p. measurements. When ionic radii are taken into account, full agreement with Debye and Hückel's theory is found for concns. >0·1N. The relation between f.p. and Λ found with H_2O solutions also holds for HCO_2H solutions. The val. $K_{8·5°} = 2·1 \times 10^{-6}$ is found for HCO_2H, giving practically complete solvolysis for K picrate and (I). Non-association of NMe_4^+ ions in HCO_2H indicates that ideal behaviour depends more on affinity with the solvent than on ε. L. J. J.

Indium. V. Hydrolysis constants for indium tribromide and triiodide solutions. T. Moeller (*J. Amer. Chem. Soc.*, 1942, **64**, 953—954).—Variations of p_H with concn. at 25° are given for pure $InBr_3$ and InI_3 solutions. Assuming that the hydrolysis products are $[In(H_2O)_5(OH)]^{++} + H_3O^+$ the calculation of hydrolysis consts. gives average vals. of $1·4 \times 10^{-5}$ and $1·8 \times 10^{-5}$ for the bromide and iodide solutions. W. R. A.

Thermodynamics of bi-univalent electrolytes. VII. Activity coefficients of lead bromide from 5° to 40°. R. G. Bates (*J. Amer. Chem. Soc.*, 1942, **65**, 1136—1139).—Activity coeffs. of $PbBr_2$ have been calc. from measurements, at 5° intervals between 5° and 40°, of the e.m.f. of the cell Pb–Hg (11%)|$PbBr_2$ (0·0015—0·08M.)|AgBr–Ag. W. R. A.

Secondary ionisation and activity coefficients of selenic acid. R. W. Gelbach and G. B. King (*J. Amer. Chem. Soc.*, 1942, **64**, 1054—1057).—A new method for determing E_0 has been developed. The e.m.f. of cells of the type quinhydrone|H_2SeO_4 (0·005—0·1M.), Ag_2SeO_4|Ag have been measured and the secondary ionisation const. of H_2SeO_4 is ~10^{-2}. The standard electrode potential $Ag|Ag_2SeO_4,SeO_4''$ is −0·8289 v. The solubility of Ag_2SeO_4 in H_2O and in H_2SO_4 has been determined. W. R. A.

Determination of activity coefficients of methylamine hydrochlorides from f.p. data. J. H. Jones and F. J. Spuhler, with W. A. Felsing (*J. Amer. Chem. Soc.*, 1942, **64**, 965—968).—The f.p. depression of aq. solutions of the three methylamine hydrochlorides (0·0025—1·0M.) have been determined using a differential f.p. apparatus. The data are given in terms of *j*-vals. at rounded concn. vals., from which provisional vals. for the activity coeffs. have been calc. Conductivity data are given. W. R. A.

Solubility of sodium carbonate in fused sodium hydroxide. R. P. Seward (*J. Amer. Chem. Soc.*, 1942, **64**, 1053—1054).—From f.p. measurements on NaOH–Na_2CO_3 (up to 35% Na_2CO_3) the following data have been obtained: f.p. of NaOH 320°, transformation temp. 294°, eutectic 286° (22% Na_2CO_3), heat of fusion of NaOH 1670 g.-cal. per mol. W. R. A.

High-temperature transitions of ferrous sulphide mixed crystals. H. Haraldsen (*Z. anorg. Chem.*, 1941, **246**, 195—226).—The phase relations in the system FeS–S have been studied in the region 50—53·4 at.-% S, and at 0—400°, by *X*-ray and magnetic methods. With rise of temp. two definite phase changes occur (α- and β-changes) together with another change which involves magnetic properties only (γ-change). The phase diagram is developed from the results. J. W. S.

Tie line correlation. D. F. Othmer and P. E. Tobias (*Ind. Eng. Chem.*, 1942, **34**, 693—696).—In equilibria relating to the distribution of a solute between two immiscible or partly miscible liquids, the plot of $(1 - a)/a$ against $(1 - b)/b$ is linear, when *a* is the wt.-fraction of solvent in one phase and *b* the wt.-fraction of diluent in the other. A simple nomograph based on this relation permits the direct determination, without calculation, of the major component in each conjugate phase; vals. for the other constituents can then be obtained from the ternary solubility diagram. Examples are given. F. L. U.

Partial pressures of ternary liquid systems and the prediction of tie lines. D. F. Othmer and P. E. Tobias (*Ind. Eng. Chem.*, 1942, **34**, 696—700).—Graphical methods are given for obtaining the partial pressure of a component *C* in a single-phase liquid system *A–B–C* when the partial pressures in the binary systems *A–C* and *B–C* are known. An equation representing the partial pressure of *C* in the single-phase system can be used in conjunction with solubility data and the partial pressures of the binary systems to give the tie lines of systems of limited miscibility. Examples are given. F. L. U.

Nitromethane–*iso*propyl alcohol–water system. Vapour–liquid equilibria in the ternary and three related binary systems. J. E. Schumacher and H. Hunt (*Ind. Eng. Chem.*, 1942, **34**, 701—704).—Solubility data for the system $MeNO_2$–$Pr^\beta OH$–H_2O and vapour–liquid equilibria data for the binary and ternary systems are given. The ternary and binary mixtures form min.-boiling azeotropes. A method for the recovery of $MeNO_2$ from the three-component mixtures by the addition of NH_4NO_3 is suggested. D. F. R.

Heat of formation and depolymerisation of phosphorus paranitride. G. Wétroff (*Compt. rend.*, 1941, **213**, 780—782; cf. A., 1939, I, 508).—The heat of formation of $(PN)_3$ found from the heat of combustion is 21±1 kg.-cal. per g.-mol. Various considerations indicate a val. ~−40 to −50 kg.-cal. per g.-mol. for the heat of depolymerisation. N. M. B.

Dissolution of cadmium iodide in alcoholic solutions. M. Miyoshi and H. Hagisawa (*Bull. Inst. Phys. Chem. Res. Japan*, 1941, **20**, 514—520).—The theoretical heats of dissolution of CdI_2 in saturated

alcoholic solution, from solubility and e.m.f. measurements, are 478 g.-cal. at 30° and 445 g.-cal. at 25°. The differential free energies of dissolution of CdI_2 are more negative in alcoholic solution than in aq. solution, suggesting a greater tendency to complex ion formation in the former. D. F. R.

Thermochemistry of the rare earths. I. Heats of dissolution of the metals of the rare earths. II. Heats of dissolution and of formation of the anhydrous chlorides of the rare earths. H. Bommer and E. Hohmann. **III. Heats of dissolution and of formation of the anhydrous iodides of the rare earths.** H. Bommer (*Z. anorg. Chem.*, 1941, **248**, 357—372, 373—382, 383—396).—I. Vals. for the heat of dissolution of the rare earth metals in 0·1N-HCl are recorded as follows: Sc, 149·0; Y, 168·3; La, 176·5; Ce, 173·7; Pr, 172·9; Nd, 171·4; Gd, 168·8; Dy, 166·0; Ho, 164·0; Er, 162·6; Tm, 161·5; Lu, 160·3 kg.-cal. per g.-atom.

II. Three types of crystal structure, designated α, β, and γ, occur among the anhyd. chlorides of the rare earths. Those of La to Gd are α, $TbCl_3$ is β, $DyCl_3$ forms both β and γ types, and those of Ho to Lu, and Y, are γ. $ScCl_3$ has a different structure. Heats of dissolution are recorded as follows: $ScCl_3$, 47·1; YCl_3, 52·3; $LaCl_3$, 31·6; $CeCl_3$, 32·7; $PrCl_3$, 33·9; $NdCl_3$, 35·9; $SmCl_3$, 39·0; $EuCl_3$, 41·15; $GdCl_3$, 42·4; $TbCl_3$, 45·85; $DyCl_3$ (β), 47·3; $DyCl_3$ (γ), 50·25; $HoCl_3$, 50·0; $ErCl_3$, 49·55; $TmCl_3$, 50·9; $YbCl_3$, 50·95; $LuCl_3$, 51·3 kg.-cal. per g.-mol. These vals. combined with the heats of dissolution of the metals in HCl give the following vals. for the heats of formation of the anhyd. chlorides: $ScCl_3$, 220·7; YCl_3, 234·8; $LaCl_3$, 263·7; $CeCl_3$, 259·8; $PrCl_3$, 257·8; $NdCl_3$ 254·3; $GdCl_3$, 245·2; $DyCl_3$ (β), 237·5; $DyCl_3$ (γ), 234·5; $HoCl_3$, 232·8; $ErCl_3$, 231·8; $TmCl_3$, 229·4; $LuCl_3$, 227·8 kg.-cal. per g.-mol. The heat of dissolution of anhyd. $ScBr_3$ is 55·1 kg.-cal. per g.-mol., and that of anhyd. $MgCl_2$ is 37·85 kg.-cal. per g.-mol.

III. LaI_3, CeI_3, PrI_3, and NdI_3 have the α structure. ErI_3, TmI_3, and LuI_3 have a structure (β') which may or may not be identical with β, and the other anhyd. iodides of the rare earths have the β structure. Heats of dissolution of the anhyd. iodides are recorded as follows: Y, 64·0; La, 48·0; Ce, 49·0; Pr, 49·9; Nd, 51·6; Sm, 55·8; Gd, 60·3; Dy, 60·4 or 60·7; Ho, 61·1; Er, 61·5; Tm, 62·6; Lu, 66·0 kg.-cal. per g.-mol. and their heats of formation as follows: Y, 143·2; La, 167·4; Ce, 163·4; Pr, 161·5; Nd, 158·3; Gd, 147·6; Dy, 144·2 or 144·5; Ho, 141·8; Er, 140·1; Tm, 137·8; Lu, 133·2 kg.-cal. per g.-mol. F. J. G.

Calorimetric investigations of organic reactions. IV. Heats of ionisation of *dl*-alanine at 25°. J. M. Sturtevant (*J. Amer. Chem. Soc.*, 1942, **64**, 762—768).—Acidic and basic ionisation heats have been calc. from calorimetric measurements of the heats of neutralisation of *dl*-alanine by HCl and NaOH at 25° and are, respectively, ~0·67 and 0·9 times those of glycine. W. R. A.

Heat of adsorption of nitric oxide by silica gel.—See A., 1942, I, 294.

Energy of immersion of crystalline powders in water and organic liquids. I. G. E. Boyd and W. D. Harkins. **Binding energy between a crystalline solid and a liquid. Energy of adhesion and emersion. Energy of emersion of crystalline powders. II.** W. D. Harkins and G. E. Boyd (*J. Amer. Chem. Soc.*, 1942, **64**, 1190—1194, 1195—1204).—I. Heats of immersion (h_i) of solids in H_2O are > those in org. liquids for polar solids but for non-polar solids are more nearly equal. The calorimetric determination of h_i is described.

II. Increases in heat content or in internal energy accompanying emersion of polar solids are > those for non-polar solids in the same liquid and, for a given solid, are greater for polar than for non-polar liquids. Mol. energies of emersion, energies of adhesion, and energies of demersion have been evaluated. W. R. A.

Thermodynamic study of the tin–bismuth system.—See A., 1942, I, 294.

Third law of classical thermodynamics. P. C. Cross and H. C. Eckstrom (*J. Chem. Physics*, 1942, **10**, 287—291).—The third law is advantageously expressed: "For any real phase, $\mathrm{Lim}_{T\to 0}(\partial S/\partial x_i)_{x_j,T} = 0$, and for any spontaneous isothermal process, $\mathrm{Lim}_{T\to 0}\Sigma_i\nu_i(\partial S/\partial n_i)_{T,y,n_j} \leq 0$. n represent composition variables, x or T and y state variables, and ν the no. of mols. of the components involved. L. J. J.

Partial pressure of hydrogen chloride from its solutions in $\beta\beta'$-dichloroethyl ether and in anisole, and the calculation of the heat and entropy of solution. S. J. O'Brien (*J. Amer. Chem. Soc.*, 1942, **64**, 951—953).—The solubilities of HCl in $(Cl\cdot[CH_2]_2)_2O$ and in PhOMe have been calc. from measurements of the partial v.p. of HCl and vals. of the differential heat and entropy of solution have been derived which agree with those obtained from infra-red absorption data. W. R. A.

VII.—ELECTROCHEMISTRY.

High mol. wt. aliphatic amines and their salts. VI. Electrical conductivities of aqueous solutions of hydrochlorides of octyl-, decyl-, tetradecyl-, and hexadecyl-amines. A. W. Ralston and C. W. Hoerr (*J. Amer. Chem. Soc.*, 1942, **64**, 772—776).—ρ and Λ have been determined at 20°, 40°, and 60°. The first member of the series behaves as a simple strong electrolyte, whilst the higher homologues behave as typical colloidal electrolytes. Vals. of Λ have been discussed in terms of modern theories of colloidal electrolytes. W. R. A.

Semi-conductors and their rôle in electro-physiology. J. Reboul (*Compt. rend.*, 1941, **213**, 344—346).—The potential distribution in Cellophane during passage of a current has been studied. Thin Cellophane sheets in which thin Cu wires were fixed were compressed between ebonite plates, a p.d. being established between two wires and the potentials of the other wires measured with an electrostatic voltmeter. The potential distribution between the electrodes was analogous to that observed by Déchene (A., 1938, I, 296). Outside the electrodes the potential decreases exponentially for 5—6 mm. and then becomes zero, in accord with theory. With an oscillograph it has been shown that on closing the circuit an impulse is produced, especially on the cathode side, which extends 10—20 cm. beyond the electrode. It corresponds with a wave of velocity 1—5 m. per sec., and on increasing the applied p.d. the response increases to a definite limit. The disturbance persists for some time after the circuit is broken. The analogy of these phenomena with those observed in physiology suggests that the nervous fibres or muscles may be regarded as semi-conductors. J. W. S.

Molal electrode potential of the silver–silver chloride electrode in ethyl alcohol–water mixtures. A. Patterson [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1942, **64**, 1478—1480).—E.m.f. measurements have been made at 25° on cells H_2 (1 atm.)|HCl (M. in 10 and 20% aq. EtOH)|AgCl–Ag. The v.p. and ρ of the solvent have been determined at 0°, 10°, 20°, 25°, 30°, and 40°. The molal electrode potentials of the Ag–AgCl electrode have been calc. for these temp. W. R. A.

Potential of the ytterbic–ytterbous ion electrode. H. A. Laitinen (*J. Amer. Chem. Soc.*, 1942, **64**, 1133—1135).—The potential of the Yb^{III}–Yb^{II} ion electrode is probably identical with the val. of the half-wave potential obtained with a Yb amalgam dropping into a Yb^{III} salt solution, viz., −1·15 v. W. R. A.

Dropping mercury electrode in acetic acid. I. Discontinuous current–voltage curves. G. B. Bachman and M. J. Astle (*J. Amer. Chem. Soc.*, 1942, **64**, 1303—1309).—The dropping Hg electrode has been applied to determinations of electro-reducible substances in anhyd. AcOH. Such substances with half-wave reduction potentials between ~−0·3 and −1·4 v. can be determined normally, whilst other substances give discontinuous curves or are interfered with by the H^+ ion curve and cannot be determined polarographically. Dissolved O_2 markedly affects current–voltage curves in AcOH. W. R. A.

Validity of the Ilkovič equation in polarographic analysis of alkali metals and the characteristics of alkali waves in various media. I. Zlotowksi and I. M. Kolthoff (*J. Amer. Chem. Soc.*, 1942, **64**, 1297—1301).—The diffusion currents of the alkali metals determined experimentally and the vals. calc. by the Ilkovič equation agree provided that the initial drop time of the capillary is ≮3 sec. The equation of the alkali metal waves corresponds with the reversible reduction of a univalent ion. Half-wave potentials of K, Na, and Li in H_2O–EtOH mixtures are const. within the concn. range investigated. W. R. A.

VIII.—REACTIONS.

Mechanism of combustion of mixtures of oxygen and hydrogen at low pressures in presence of carbon monoxide. M. Prettre (*Compt. rend.*, 1941, **213**, 29—31).—Mixtures of H_2, O_2, and CO react according to a chain mechanism with a velocity given by $V = k[CO][H_2]/(1 + 0{\cdot}48[H_2])$. The $[O_2]$ may be regarded as const. as it is always taken in considerable excess over $[H_2]$. The occurrence of $[H_2]$ in this equation is similar to that observed for many other reactions of order between zero and unity. The occurrence of a heterogeneous reaction in the present case agrees with experimental evidence. The mechanism is: (1) H_2 (gas) = 2H (adsorbed); (2) $H + O_2 = HO_2$; (3) $HO_2 + CO = CO_2 + OH$; (4) $OH + CO = CO_2 + H$, etc. Theory gives an expression for the velocity similar to that given above. A. J. M.

Experimental criteria for recognition of chain-thermal explosions. F. S. Dainton (*Trans. Faraday Soc.*, 1942, **38**, 227—238).—The characteristics of gaseous reactions in which the liberated heat is, and is not, a contributory cause of explosion are described, and nine experimental tests, which may be used to identify a reaction as belonging to the former (chain-thermal) or the latter (chain-isothermal) group, are based on the differences. Examples are given to illustrate the application of the tests. F. L. U.

Kinetics of gaseous reactions by means of the mass spectrometer. Thermal decomposition of dimethyl ether and acetaldehyde. E. Leifer and H. C. Urey (*J. Amer. Chem. Soc.*, 1942, **64**, 994—1001).—The thermal decomp. of Me_2O and MeCHO at 504° has been studied by a mass spectral method which has advantages over existing

methods but the possible error of which is ±5%. MeCHO decomposes to CH_4 and CO, with small amounts of C_2H_2 and H_2O. In the decomp. of Me_2O CH_2O is a stable intermediate. Thus the main products are CH_4, CO, and H_2, but C_2H_6 (0·8%) is also formed. There is no evidence of polymerisation of CH_2O or Me_2O. The effects of (i) packing the reaction vessel to various extents with Pyrex, (ii) initial pressure of Me_2O, and (iii) added gases (N_2, CH_2O, He, H_2, and D_2) are discussed. The exchange reaction between Me_2O and D_2 has been investigated. Production of C_2H_6 in the decomp. of Me_2O postulates a chain mechanism with a chain length of 100. Advantages and limitations of the method are discussed. W. R. A.

Kinetics of the degradation of chain molecules. II. Mol. wt. distribution which appears during the degradation of materials with chain molecules. G. V. Schulz (*Z. physikal. Chem.*, 1942, **B**, **51**, 127—143).—Kuhn's equation (A., 1930, 1025) for the mol. wt. distribution of the fragments produced by degradation of long-chain compounds holds when the mol. wt. distribution before the degradation is also in accord with this equation and also holds for all cases when the mean mol. wt. is decreased considerably during the degradation. Corrections are calc. for the case where mols. of uniform chain length are slightly degraded. Relationships between the mean degree of polymerisation and the viscosimetrically determined degree of polymerisation and between the heterogeneity of the product and its degree of degradation are derived. J. W. S.

Exchange reaction between simple alkyl iodides and iodide ion. H. Seelig and D. E. Hull (*J. Amer. Chem. Soc.*, 1942, **64**, 940—948).—The rate of exchange of I between EtI, Pr$^\alpha$I, and Pr$^\beta$I and NaI in EtOH has been studied using ^{128}I as indicator at temp. between 50° and 70° by pptg. radioactive samples as AgI. Activation energies and collision diameters have been calc. The activation energies are Pr$^\beta$ > Pr$^\alpha$ ≃ Et and tentative explanations are advanced. W. R. A.

Hydrolysis of acid amides in concentrated hydrochloric acid solutions. B. S. Rabinovitch and C. A. Winkler (*Canad. J. Res.*, 1942, **20**, **B**, 73—81).—The hydrolysis of HCO·NH_2, NH_2Ac, EtCO·NH_2, and NH_2Bz in 1—10N-HCl has been investigated and the consts. of the Arrhenius equation have been evaluated. There is approx. correspondence between activation energy and reaction rate for the series. Activation energy increases with increasing acid concn. for all the amides. A max. rate of hydrolysis occurs at higher acid concns., and can be accounted for by the variation of the Arrhenius consts. with acid concn. A. J. M.

Reaction-rate formulæ for heterogeneous reactions at phase boundaries of solids. I. Development of mathematical method and derivation of surface reaction formulæ. K. L. Mampel (*Z. physikal. Chem.*, 1940, **A**, **187**, 43—57).—Formulæ for the kinetics of a pure surface reaction proceeding by formation of reaction nuclei at a const. rate per unit unreacted surface area, followed by radial spreading of the reaction from such nuclei, are derived. L. J. J.

Reaction-rate formulæ for heterogeneous reactions at the phase boundaries of solids. II. Time-conversion formula for a powder of spherical particles. K. L. Mampel (*Z. physikal. Chem.*, 1940, **A**, **187**, 235—249; cf. preceding abstract).—Mathematical. O. D. S.

Corrosion investigations on thallium. E. Plank and A. Urmánczy (*Korros. u. Metallschutz*, 1940, **16**, 33—38).—The velocity of corrosion of Tl in aq. HCl or H_2SO_4 in presence of air increases with increasing acid concn. to a max. and then decreases with further increase in concn. This behaviour is correlated with the rate of diffusion of Tl$^+$ and acid ions in the diffusion film on the metal surface, the max. being explained by the formation of a deposit of the sparingly sol. Tl salt. With HNO_3 the rate of dissolution is much greater and no max. velocity is attained in the concn. range 0·01—0·5N-HNO_3. In H_2O the velocity of corrosion of Tl ∝ the amount of dissolved O_2. Tl is unattacked in O_2-free H_2O saturated with H_2. J. W. S.

Rate of oxidation of typical non-ferrous metals as determined by interference colours of oxide films.—See B., 1942, I, 354.

Gaseous hydrogenation and polymerisation reactions. H. D. Burnham and R. N. Pease (*J. Amer. Chem. Soc.*, 1942, **64**, 1404—1410).—The polymerisation of C_2H_4 and C_3H_6 and the hydrogenation of C_2H_4 are inhibited by small initial additions of NO. The results suggest a chain mechanism for these reactions and that the NO acts by combining with the free radicals or atoms and effectively prevents their further participation in the chain reaction. Small additions of NO do not inhibit the polymerisation and hydrogenation of C_3H_6 but cause a slight acceleration. The catalytic effect of NO does not support or deny the possibility of a chain mechanism in the C_2H_6 reactions. W. R. A.

Non-peroxide catalysts for the reaction between sulphur dioxide and olefines. C. S. Marvel, L. F. Audrieth, and W. H. Sharkey (*J. Amer. Chem. Soc.*, 1942, **64**, 1229—1230).—NMe_3O and $NPhMe_2O$ catalyse the addition of SO_2 to Δ^α-pentene, -hexene, and -heptene, Δ^β-butene, and Δ^α-pentinene. Halogen salts of NMe_3O increase the catalytic activity. NH_2OH,HCl, o-$C_6H_4(CO)_2NH$, and NMe_4Cl(Br) showed some activity but NR_4I showed none. W. R. A.

Effect of catalysis on oxidation products of hydroxylamine. T. H. James (*J. Amer. Chem. Soc.*, 1942, **64**, 731—734).—Under proper conditions $Hg_2(NO_3)_2$ oxidises NH_2OH without an induction period and produces chiefly N_2O. A progressive increase in the yield of N_2 is produced by the addition of colloidal Hg or Ag catalyst. The product of the catalysed reaction is principally N_2. The product of the oxidation of NH_2OH by Ag salts in strongly alkaline solution varies considerably with the nature of the salt and reaction conditions. At p_H 12·7 N_2 yields ranging from 5 to 90% were obtained. Kinetic data on the initial uncatalysed reaction of $Ag_2S_2O_3$ complex were obtained. The catalysed reduction involves adsorption of NH_2OH to Ag, but not adsorption of Ag$^+$ ions or complex. The metal-catalysed oxidation of NH_2OH by Hg^I and Ag salts yields almost entirely N_2 whilst the uncatalysed reaction yields chiefly N_2O. W. R. A.

Effect of inorganic salts on ketone decomposition of oxaloacetic acid. H. A. Krebs (*Biochem. J.*, 1942, **36**, 303—305).—Unlike amines, which catalyse the decomp. of all β-keto-acids and of some α-keto-acids, multivalent cations, *e.g.*, Al$^{...}$, Cu$^{..}$, Fe$^{..}$, Fe$^{...}$, etc., react only with β-keto-dicarboxylic acids, *e.g.*, oxaloacetic and acetonedicarboxylic acids. The optimum p_H is ~4, little decomp. occurring at p_H 1 or 13 even at 40°. P. G. M.

Mutarotation of α-*d*-glucose in dioxan–water mixtures at 25°. H. H. Rowley and W. N. Hubbard (*J. Amer. Chem. Soc.*, 1942, **64**, 1010—1011).—In dioxan–H_2O mixtures the catalytic effect of dioxan on the mutarotation of α-*d*-glucose is small. W. R. A.

Methyl methacrylate polymerisation. Peroxide catalysis and oxidation of quinol inhibitor.—See B., 1942, II, 293.

Adsorption of nitrogen and the mechanism of ammonia decomposition over iron catalysts. S. Brunauer, (Miss) K. S. Love, and R. G. Keenan (*J. Amer. Chem. Soc.*, 1942, **64**, 751—758).—Equations have been derived for the rates of adsorption and desorption and for the adsorption isotherm when (i) the surface is heterogeneous and the heat of adsorption and energies of adsorption and desorption vary linearly between the max. and min. vals., and (ii) when there are forces of attraction or repulsion between the adsorbed particles and the heat of adsorption and energies of adsorption and desorption vary linearly with the fraction of the surface covered. Adsorption isotherms of N_2 on Fe and an equation for the rate of decomp. of NH_3 on doubly-promoted Fe catalyst 931 have been obtained from data on rates of adsorption and agree well with experimental vals. W. R. A.

Effect of alkali promoter concentration on the decomposition of ammonia over doubly promoted iron catalysts. (Miss) K. S. Love and S. Brunauer (*J. Amer. Chem. Soc.*, 1942, **64**, 745—751).—Doubly promoted catalysts were prepared by treating an Al_2O_3-promoted Fe catalyst with KOH solutions of various concns. By means of adsorption measurements the total surface areas and surface concns. of the promoters have been determined for each catalyst and the effects of temp. and gas composition on the kinetics of decomp. of NH_3 have been studied. When ~30% of the catalyst surface is covered by KOH the catalyst is most active towards NH_3 decomp. W. R. A.

Mechanism of catalytic synthesis of ammonia.—See B., 1942, I, 340.

Analysis of process of reduction of ammonia catalysts.—See B., 1942, I, 340.

Effect of poisons on rate of hydrogenation of adsorbed nitrogen.—See B., 1942, I, 340.

Thermal decomposition of nitrous oxide. (Mlle.) A. Cheutin (*Compt. rend.*, 1941, **213**, 26—29).—Pt, not previously heated in N_2O, has only very weak catalytic effect on the decomp. of the gas, but the effect increases with use, as shown by the fall in the reaction temp. $CaCO_3$ has considerable catalytic effect on the thermal decomp. of N_2O, if lowering of temp. of decomp. is taken as the criterion. A. J. M.

Catalytic polymerisation of olefines in presence of phosphoric acid. A. Farkas and L. Farkas (*Ind. Eng. Chem.*, 1942, **34**, 716—721).—A D_3PO_4 catalyst was used, forming polymers containing D, with exchange of H atoms between olefine and catalyst. Under similar conditions polymerisation and exchange of n-C_4H_8 are slower than the reactions of *iso*-C_4H_8; those of C_3H_6 and C_2H_4 are still slower. No exchange of *iso*-C_4H_8 was observed, whilst di*iso*butene polymeride may undergo further exchange in contact with the D_3PO_4. A modified form of Ipatiev mechanism for the polymerisation is suggested, in which the catalyst and olefine mol. can combine to two different forms, one resulting from the transfer of one H atom from the catalyst to the olefine and the other by the reverse transfer, the polymeride being formed by the interaction of these two forms. D. F. R.

New methods of preparative organic chemistry. XV. Hydrogenation with copper–chromium oxide catalysts. C. Grundmann (*Angew. Chem.*, 1941, **54**, 469—474). D. F. R.

Regeneration of Raney catalyst for organic synthesis.—See B., 1942, II, 273.

Catalytic hydrogenation of coal.—See B., 1942, I, 329.

Anomalous electro-reduction of water at the dropping mercury electrode in relatively concentrated salt solutions. E. F. Orlemann and I. M. Kolthoff (*J. Amer. Chem. Soc.*, 1942, **64**, 833—838).—In salt solutions (>0·5M.) passage of a current causes electro-reduction of H_2O at the dropping Hg electrode and the H_2O current $\propto$ total current flowing. This H_2O current is suppressed by 0·01% gelatin. The effects of other strongly adsorbed substances are discussed and interpreted and a quant. interpretation of the conditions necessary for the H_2O current is given. W. R. A.

Reduction of iodate and bromate in acid medium at the dropping mercury electrode. E. F. Orlemann and I. M. Kolthoff (*J. Amer. Chem. Soc.*, 1942, **64**, 1044—1052).—The reduction has been studied in buffered solutions of various p_H. In dil. solutions of strong acids two waves are obtained with IO_3' and BrO_3' when $[H^+]$ is $<2[IO_3']$ or $<2{\cdot}3[BrO_3']$. Half-wave potentials of IO_3' and BrO_3' vary with change in drop time but are independent of $[1(Br)O_3']$. Mechanisms for the irreversible reduction of both ions in buffered solutions have been advanced. W. R. A.

Mixed electrolysis of nitrate with *n*-valerate and *iso*butylacetate.—See A., 1942, II, 277.

Polarographic investigation of rhenium compounds. I. Reduction of perrhenate ion at the dropping mercury electrode. J. J. Lingane (*J. Amer. Chem. Soc.*, 1942, **64**, 1001—1007).—In HCl or $HClO_4$ (2—4N.) as supporting electrolyte ReO_4' is reduced to Re^{+4} at the dropping electrode. In 4N-$HClO_4$ the diffusion current is well-defined and $\propto [ReO_4']$. In neutral unbuffered solutions of KCl a double wave is obtained; the first part of the wave is due to the reduction $ReO_4' \rightarrow Re'$ and the second part of the wave to the catalytic discharge of H_2. Data concerning the catalytic wave of ReO_4' in buffered solution are also given. W. R. A.

Cathodic deposition of metal powders. M. Passer (*Kolloid-Z.*, 1941, **97**, 272—280).—Published work is summarised. Experiments on the cathodic deposition of Zn from zincate solutions show that factors which hinder the growth of nuclei or of crystallites favour the production of powder whilst mechanical disturbances due to gas bubbles or turbulent motion of the electrolyte near the cathode tend to produce a coherent deposit, this effect probably being due to diminution of the concn. polarisation and to the resulting decrease of potential gradient at the cathode. F. L. U.

Preparation of metallic phosphides by igneous electrolysis. M. Chene (*Ann. Chim.*, 1941, [xi], **15**, 187—282).—By electrolysis of solutions of metallic oxides in fused $NaPO_3$ or $Na_4P_2O_7$ the following new *phosphides* have been obtained: Ni_3P (ρ 7·6), Ni_5P_2, CoP_2, Mo_3P, V_2P (ρ 4·5), and VP (ρ 4·0). Cryst. specimens of the following known phosphides may be obtained in this way: Fe_3P, Fe_2P, FeP, FeP_2, Ni_5P_2, Ni_2P, Co_2P, CoP, MoP, W_2P, WP, Mn_2P, MnP (ρ 5·6), CrP. F. J. G.

Factors determining electrical properties of the lead accumulator.—See B., 1942, I, 323.

Preparation of fluorine.—See B., 1942, I, 341.

Oxidation of ammonium sulphite to ammonium sulphate by electrolytic oxygen.—See B., 1942, I, 341.

Electrolytic behaviour of ferrous and non-ferrous metals in soil-corrosion circuits.—See B., 1942, I, 351.

Chemical action of electric discharges. XXVIII. Action of the high- and low-frequency electric arc on the systems nitrogen–water vapour and air–water vapour. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1942, **25**, 530—538).—High-frequency arcs are more favourable than low for N_2 fixation from N_2–H_2O mixtures, yields equiv. to 20 g. of HNO_3 per kw.-hr. being attainable. Addition of H_2O to air has only a slight effect on N_2 fixation. C. R. H.

Decomposition of methane in glow discharge at liquid-air temperature. L. M. Yeddanapalli (*J. Chem. Physics*, 1942, **10**, 249—260).—The reaction products are invariably H_2, $(CH_2)_n$, C_2H_6, C_2H_4, and C_2H_2. Presence of H_2 favours C_2H_4 and C_2H_2 formation at the expense of C_2H_6. In the negative glow the reaction rate is $\propto$ the current, and the electron efficiency is ~10 mols. CH_4 decomposed per electronic charge for a.c. or d.c. In the positive column the rate increases with pressure and field strength and is $\propto$ the current for const. pressure and field strength; the electron efficiency is ~0·2 for a.c. and ~0·6 for d.c. L. J. J.

Photolysis of persulphate. L. J. Heidt (*J. Chem. Physics*, 1942, **10**, 297—302).—0·1—1M-$K_2S_2O_8$ solutions in H_2O, irradiated with λ 254 mμ. at 10—21°, decompose by the reaction $S_2O_8'' + H_2O + h\nu = 2HSO_4' + 0{\cdot}5O_2$, with a quantum yield of 0·58±0·02 in neutral and alkaline solution and 1·0 in dil. AcOH solution. The val. is lowered by non-oxidisable ions, and is <0·01 in acidified solutions. It is concluded that ($S_2O_8 + h\nu$) is stabilised by association with H^+, since absorption spectra and conductivity vals. give no indication of formation of a weak acid. The main reaction is not decomp. of SO_4'. No H_2O_2 is formed. L. J. J.

Zinc-photosensitised reactions of ethylene. H. Habeeb, D. J. LeRoy, and E. W. R. Steacie (*J. Chem. Physics*, 1942, **10**, 261—267).—Rapid polymerisation of C_2H_4 is produced by λ 2139 A. in presence of Zn, the products being C_3H_6, C_4H_8, and traces of higher hydrocarbons. The rate of polymerisation increases rapidly with $[C_2H_4]$. The initial step $Zn(4^1P_1) + C_2H_4 = ZnH + C_2H_3$ is suggested. With λ 3076 A. the reaction is very slow. H_2 markedly accelerates the reaction with λ 3076 A. L. J. J.

Photolysis of the aliphatic aldehydes. X. Acetaldehyde and iodine mixtures. XI. Acetaldehyde and iodine mixtures. F. E. Blacet and J. D. Heldman. **XI.** F. E. Blacet and D. E. Loeffler (*J. Amer. Chem. Soc.*, 1942, **64**, 889—893, 893—896).—X. The photolysis of MeCHO with and without I at 3130 A. has been investigated from 60° to 170°. MeCHO (10^{-2} mol. per l.) gives a quantum yield (Φ) of 0·34 at 60° for CO, increasing to 2·29 at 135°. When I vapour is added Φ_{CO} at 60° decreases with [I] (1—3 mm.) to a const. val. of 0·21, whilst increase in I from 0 to 1 mm. causes Φ_{CH_4} to decrease from 0·32 to 0·013, and Φ_{MeI} to increase from zero to 0·20. With a sufficiently high [I] Φ_{CO} and Φ_{MeI} remain approx. const. from 60° to 170°. No AcI is formed, only traces of H_2, and considerable quantities of HI. Formation of free Me and CHO groups is the predominant primary dissociation process and they react readily with I, thus stopping secondary processes. I does not react readily with activated MeCHO mols. nor do Me and CHO radicals recombine. The primary dissociation quantum yield is 0·20 and collisional deactivation accounts for a large part of the total absorbed radiant energy.

XI. In the absence of I at 2654 A. Φ_{CO} is 0·78 at 60° and 5·85 at 150°. In presence of I (1·0—2·5 mm.) the vals. of Φ_{CO}, Φ_{MeI}, and Φ_{CH_4} from 200 mm. MeCHO at 60° and different $\lambda\lambda$ are given (*e.g.*, at 3130A. 0·21, 0·20, 0·013). With sufficient I to suppress secondary reactions $\Phi_{CO} \simeq \Phi_{MeI} + \Phi_{CH_4}$. In the absence of I the photolysis chain process requires an activation energy of 9·6 kg.-cal., chiefly for the reaction $MeCO + M = Me + CO + M$. The dissociation into Me and CHO radicals at 3130 A. becomes less important at shorter $\lambda\lambda$ and the dissociation into CH_4 and CO becomes increasingly important and attains equal probability at 2380 A. W. R. A.

Ultra-violet absorption and photochemical decomposition of aqueous solutions of ascorbic acid in the ultra-violet. (Miss) S. Guinand and B. Vodar (*Compt. rend.*, 1941, **213**, 526—528).—Beer's law was verified over a wide concn. range. The most rapid photochemical decomp. was obtained by the far ultra-violet radiation from the spark spectra of Zn or Cd. N. M. B.

Importance in radiobiology of the activation of oxygen. J. Loiseleur, R. Latarjet, and (Mlle.) T. Caillot (*Compt. rend.*, 1941, **213**, 730—732).—The formation of H_2O_2 in the *X*-irradiation of H_2O at p_H 2·2—9 is facilitated by the presence of dissolved O_2. J. L. E.

IX.—METHODS OF PREPARATION.

Chemical processes in which solids participate. III. Processes of metal ceramics and oxide ceramics. Sintering processes in powders consisting of a single component. G. F. Hüttig (*Kolloid-Z.*, 1941, **97**, 281—300).—A review of the literature and a discussion of the thermodynamics of sintering. F. L. U.

Magnetochemical study of the amidosulphonates and imidodisulphonates and basic salts of copper. L. Lecuir (*Ann. Chim.*, 1941, [xi], **15**, 33—96).—The following *compounds* are described: $Ag_5H(N{\cdot}SO_3Na)_3,4H_2O$; $Ag_2NSO_3,3NH_3,3H_2O$; $Cu(NH_2{\cdot}SO_3)_2,4NH_3,H_2O$ (**I**); $CuBa_2[N(SO_3)_2]_2,6H_2O$ (**II**); $Cu_2NaN(SO_3)_2,4NH_3,2{\cdot}5H_2O$ (**III**). Vals. of χ for (**I**), (**II**), and (**III**), and for other Cu derivatives of amido- and imidodi-sulphonic acid, and for a large no. of basic Cu salts and basic Cu double salts, are recorded and discussed. F. J. G.

Calcium complexes of sodium hexameta- and tripoly-phosphate. H. Rudy, H. Schloesser, and R. Watzel (*Angew. Chem.*, 1940, **53**, 525—531).—Recent investigations on H_2O-softening problems are discussed and new experiments are described. Ca complexes are more readily formed by $Na_6P_6O_{18}$ than by $Na_5P_3O_{10}$. Complex formation by $Na_6P_6O_{18}$ is much less influenced by p_H than in the case of $Na_5P_3O_{10}$; the ratio of % complex formation being ~80 : 50 at p_H 8—13. At p_H 4—5 complex formation is at a min., the ratio being ~70 : 5. At p_H 3 complex formation increases and is 100% in the case of $Na_6P_6O_{18}$. Complex formation is almost independent of [Ca]. The dissolution of Ca soaps is greatly dependent on temp. At room temp. $Na_5P_3O_{10}$ is less effective in this connexion than $Na_6P_6O_{18}$, but at ~80° they are equally effective. The complexes formed by these two salts at room temp. and in the p_H range 8—9

appear to be $Ca(Na_4P_3O_{10})_2$ and $Na_4CaP_6O_{18}$ respectively. So-called tetrapolyphosphate is probably a mixture, the properties of which lie between those of $Na_5P_3O_{10}$ and $Na_6P_6O_{18}$. $Na_4P_2O_7$ does not tend to form complexes, its action depending on the formation of sparingly sol. $Ca_2P_2O_7$ and $Na_2CaP_2O_7$. C. R. H.

Calcium complexes of sodium hexameta- and tripoly-phosphate. II. H. Rudy (*Angew. Chem.*, 1941, **54**, 447—449; cf. preceding abstract).—The dissolution of Ca oleate in the presence of $Na_6P_6O_{18}$ (**I**) and $Na_5P_3O_{10}$ (**II**) was studied at 60—95° and in p_H ranges 9·2—9·5, 10·9—11·2, and 12·3—12·7. The effect of (**I**) is least influenced by temp. and p_H; (**II**) has a relatively small optimum temp. range, especially at the lowest p_H. D. F. R.

Structure of the compounds InP, InAs, and InSb. A. Iandelli (*Gazzetta*, 1941, **71**, 58—62).—In with P, As, and Sb at 700° slowly gives *InP*, *InAs*, and *InSb*. These have face-centred cubic structure (ZnS type); a = 5·861, 6·036, and 6·461 A., respectively. E. W. W.

Zirconium compounds with transition elements. H. J. Wallbaum (*Naturwiss.*, 1942, **30**, 149).—Zr (at. radius 1·60 A.) would be expected to form intermetallic compounds with other transition elements with a radius ratio r_{Zr}/r_X ~1·23. Debye-Scherrer diagrams of sintered mixtures of Zr with powdered Re, V, Os, Ru, Cr, and Ir indicate the existence of such *compounds* of the $MgZn_2$ type. The lattice consts. of these compounds are given. The existence of Mo_2Zr is also indicated. A. J. M.

Purification of thorium chloride octahydrate. C. B. Kremer (*J. Amer. Chem. Soc.*, 1942, **64**, 1009—1010).—$ThCl_4,8H_2O$ has been purified by dissolving it in 6M-HCl, filtering through asbestos, extracting with Et_2O and evaporating to small vol. SiO_2, which separates, is filtered off. The filtrate, cooled to 0°, is saturated with dry HCl and an equal vol. of Et_2O added, homogeneity being obtained by agitation with HCl. Pure $ThCl_4,8H_2O$ separates. W. R. A.

Radio-halogen exchanges in the phosphorus halides. W. Koskoski and R. D. Fowler (*J. Amer. Chem. Soc.*, 1942, **64**, 850—852).—Since exchange between Br* and PBr_3, Cl* and PCl_3, and Cl* and PCl_3 in CCl_4 is complete in 3 min., it is concluded that all five halide atoms in PCl_5 and PBr_5 are equally reactive. W. R. A.

Preparation of *N*-substituted derivatives of the phenyl esters of amido- and diamido-phosphoric acids.—See A., 1942, II, 281.

Vanadates. H. Guiter (*Ann. Chim.*, 1941, [xi], **15**, 5—32).—The following *vanadates are* described: $K_2O,3V_2O_5,3H_2O$; $K_2O,5V_2O_5,7H_2O$; $2Na_2O,V_2O_5,6H_2O$; $Na_2O,V_2O_5,3{\cdot}5H_2O$; $3Na_2O,4V_2O_5,16H_2O$; $Na_2O,2V_2O_5,8H_2O$; $Na_2O,2V_2O_5,4H_2O$; $3Na_2O,7V_2O_5,35H_2O$; $2Na_2O,5V_2O_5,25H_2O$; $Na_2O,3V_2O_5,6H_2O$; $Na_2O,5V_2O_5,9H_2O$; $6BaO,7V_2O_5,9H_2O$; $10SrO,3V_2O_5$; $6SrO,7V_2O_5$; $2SrO,3V_2O_5$; $CaO,4V_2O_5$; Hg_2VO_4; $3Hg_2O,V_2O_5$; $Ag_2O,2V_2O_5$; $5MgO,V_2O_5$; $7ZnO,2V_2O_5$; $4CdO,V_2O_5$; $Cd_2V_2O_7$; $5MnO,2V_2O_5$; $3CoO,V_2O_5$; $5NiO,2V_2O_5$; $5CuO,2V_2O_5$; $5HgO,V_2O_5$; $2Fe_2O_3,3V_2O_5$; Fe_2O_3,V_2O_5; $Fe_2O_3,3V_2O_5$. The conditions of p_H under which these and other known vanadates are formed are recorded. F. J. G.

Bismuthates. R. Scholder and H. Stobbe (*Z. anorg. Chem.*, 1941, **247**, 392—414).—The oxidation of Bi^{III} [Bi_2O_3 or $Bi(NO_3)_3,5H_2O$] in aq. NaOH solutions has been investigated and the effect of the oxidising agent, temp., and [NaOH] has been studied. In 25—50% NaOH at temp. >100° using large excess of NaOCl or Br a brown oxidation product with 92—97% of the total Bi as Bi^V was obtained; with more dil. NaOH (5—22%) the oxidation product was dark green to black, depending on the NaOH concn., the amount of Bi^V being 30—90%. Washing the brown product with H_2O or cold MeOH left crude yellow Na metabismuthate (92—97%), from which pure $NaBiO_3$ (99—100%) was prepared by boiling with 50% NaOH and washing with much H_2O, both anhyd. and in the form of hydrates. Pure $KBiO_3,0{\cdot}33H_2O$ was prepared by oxidation of Bi in dil. KOH, black oxidation products of varying composition being obtained. Orange-coloured Ca and Ba metabismuthates and black $AgBiO_3$ were prepared by double decomp. of alkali metabismuthates with solutions of the corresponding metal salts. Decomp. of $NaBiO_3$ or $KBiO_3$ with acids yielded products the composition, colour, chemical behaviour, and *X*-ray diagram of which showed them to be higher oxides of Bi. J. L. E.

Reactions involving oxygen, amalgams, and hydrogen peroxide. H. A. Liebhafsky (*J. Amer. Chem. Soc.*, 1942, **64**, 852—856).—Reaction systems composed of O_2, amalgams, and H_2O_2 have been investigated to ascertain if they reach a steady state in which O_2 and base metal are used up whilst $[H_2O_2]$ remains const. Such a steady state was attained only with Zn–Hg but there is evidence that other base metal amalgams behave similarly. The reduction of H_2O_2 by Zn, Tl, Cd, and Pb amalgams has been investigated. O_2 is not necessarily reduced to H_2O_2 (as an isolable intermediate) by the baser metals and is more likely reduced to H_2O. With Cu amalgam O_2 is stoicheiometrically reduced to H_2O_2. W. R. A.

Formation of complexes of tartaric and metatungstic acids. (Mlle.) M. Murgier and (Mlle.) M. Cordier (*Compt. rend.*, 1941, **213**, 729—730).—The (1 : 1) complexes produced by the action of $H_2W_4O_{13},8H_2O$ on $[CH(OH)\cdot CO_2H]_2$ are described. J. L. E.

Reactions of bromine with carbon tetrachloride and tetrachloroethylene following neutron capture and isomeric nuclear transition. E. G. Bohlman and J. E. Willard (*J. Amer. Chem. Soc.*, 1942, **64**, 1342—1346).—The nuclear n, γ process whereby Br* is produced causes reaction between Br and CCl_4 in solution but practically no reaction in the gas phase. The isomeric transition and neutron capture reactions of Br with CCl_4 give an appreciable fraction of compounds containing org. bound Br*, having b.p. > that of CCl_3Br, indicating that the mechanism of reaction involves a disruption of the CCl_4 mol. more serious than the removal of a single Cl. Br reacts with liquid C_2Cl_4 following neutron capture and isomeric transition with probabilities of ~37% and ~85% respectively. It will react in the gas phase following isomeric transition but not following neutron capture. The different probabilities of reaction following the two types of activation are discussed and support the Franck and Rabinowitsch "cage" hypothesis (A., 1933, 1255). W. R. A.

Products obtained by the reducing action of metals on salts in liquid ammonia solution. VII. Reduction of complex nickel cyanides. Univalent nickel. J. W. Eastes and W. M. Burgess (*J. Amer. Chem. Soc.*, 1942, **64**, 1187—1189).—Alkali metal cyanonickelates (**I**) are reduced by alkali metals in anhyd. liquid NH_3 to products in which Ni has a valency of <2. When there is excess of alkali metal the product has the empirical formula $M^I_4Ni(CN)_4$ but when (**I**) is in excess a product, isolable from anhyd. NH_3 and from H_2O, is a *cyanonickelite*, $M^I_2Ni(CN)_3$. On exposure to air the red colour of $M_2Ni(CN)_3$ becomes paler and finally yellow; in aq. solution it is deep red but the colour fades with time, and $Ni(OH)_2$ is pptd. Aq. $K_2Ni(CN)_3$ instantly reduces $AgNO_3$ or $AuCl_3$ to Ag or Au. W. R. A.

Formation of double hydroxides between bi- and ter-valent metals. W. Feitknecht (*Helv. Chim. Acta*, 1942, **25**, 555—569).—Of 19 double hydroxides of Ni, Mg, Co^{II}, Zn, Mn^{II}, Cd, or Ca with Al, Co^{III}, Fe^{III}, Mn^{III}, Cr^{III}, or La, 17 have a double layer lattice, the exceptions being Mg Cr^{III} and Cd Fe^{III} hydroxides. Lattice consts. for 16 hydroxides are recorded. Structural differences are discussed. C. R. H.

Metal carbonyls. XXXVI. Carbon monoxide compounds of iridium halides. W. Hieber, H. Lagally, and A. Mayr (*Z. anorg. Chem.*, 1941, **246**, 138—148).—The *compounds* $IrX_2(CO)_2$ and $IrX(CO)_2$ (X = Cl, Br, or I) have been obtained by interaction of CO with the corresponding halides at atm. pressure and 150°. Their formation indicates that the formation of $\{Ir(CO)_3\}_x$ from the halides does not occur through the metal. The crystal structure of $\{Ir(CO)_3\}_x$ is discussed. J. W. S.

X.—ANALYSIS.

Progress in microchemistry. IV. Radiochemistry. Separation of elements in unweighable quantity. O. Erbacher (*Angew. Chem.*, 1941, **54**, 485—491).—A lecture. O. D. S.

Potentiometric titration of dibasic acids in dioxan–water mixtures. R. H. Gale and C. C. Lynch (*J. Amer. Chem. Soc.*, 1942, **64**, 1153—1157).—The Auerbach–Smolczyk treatment of acid–base titration for weak dibasic acids has been extended to include the influence of ion-association of salts in low dielectric media and an equation for these effects has been developed. Potentiometric titrations of $H_2C_2O_4$, $CH_2(CO_2H)_2$, $(CH_2\cdot CO_2H)_2$, and glutaric acid in H_2O–dioxan have been made with a quinhydrone–Hg_2SO_4 electrode chain with high $[LiSO_4]$ and the data have been used in support of the extended theory. W. R. A.

Determination of small amounts of iodide in photographic developers.—See B., 1942, II, 304.

Determination of oxygen in gas mixtures by physical methods. F. Klauer, E. Turowski, and T. von Wolff (*Angew. Chem.*, 1941, **54**, 494—496).—The determination is based on an effect due to the high paramagnetic susceptibility of O_2. A hot wire in a gas containing O_2 loses heat more rapidly in a magnetic field since the heated gas near the wire has susceptibility < that of the body of the gas and moves to regions of lower flux density, producing a gas stream over the wire. The effect opposes and under these conditions is > the Senftleben effect (A., 1938, I, 22). O_2 from 0 to 100% in gas mixtures is determined to ~1%, or from 0 to 20% to ~0·2%. O. D. S.

Detection and determination of selenium and tellurium in copper.—See B., 1942, I, 351.

Determination of nitrites [in water].—See B., 1942, III, 192.

Colorimetric determination of phosphorus in iron ore.—See B., 1942, I, 348.

Rapid spectrographic determination of minute amounts of arsenic, lead, and copper and other heavy metals in foodstuff colours and medicinals.—See B., 1942, III, 187.

Spectrochemical determination of boron in synthetic mixtures of soil materials. R. Q. Parks (*J. Opt. Soc. Amer.*, 1942, **32**, 233—237).—The sample (0·05 g.) was mixed with about twice its wt. of $CaCO_3$ as buffer and 1 c.c. of 0·03% $SnCl_2$ or SnI_2 as internal standard. Exposures with a 2200-v. a.c. arc were compared with those with three standards of known B content plotted against the ratio of intensities of the 2497·7 A. B and the 2429·5 A. Sn lines. Results were accurate to 3—10%. N. M. B.

Determination of K_2O in commercial fertilisers using 95 and 80% alcohol and acid–alcohol.—See B., 1942, III, 178.

Determination of strontium in presence of calcium. P. B. Stewart and K. A. Kobe (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 298—299).—The $COMe_2$ extraction method (A., 1939, I, 337) is unsatisfactory when the ratio Ca : Sr is >3 : 1. The method now described uses a standardised procedure, and a calibration curve for correction of the actual data obtained. L. S. T.

Critical study of qualitative reagents for cations. IV. Reagents for zinc cations. P. Wenger and R. Duckert [with D. Rieth] (*Helv. Chim. Acta*, 1942, **25**, 406—415).—A no. of reagents which have been suggested for the detection of $Zn^{··}$ have been tested and data on their sensitivity and specificity are tabulated. Fuller details are given for operation with 15 reagents which are recommended for use. J. W. S.

Examination of zinc oxide.—See B., 1942, I, 341.

Determination of lead in silicate rocks. I. T. Rosenqvist (*Amer. J. Sci.*, 1942, **240**, 356—362).—Enrichment of Pb is effected by co-pptn. with $SrSO_4$; this method is superior to that in which Pb is pptd. as PbS in presence of $Ag^{·}$. The Pb is determined finally as PbO_2 by electrolysis. The Pb content of the Norwegian granite, gneiss-granite, augengneiss, and Nordmarkite porphyry examined is approx. const. at 10—20 g. per ton. L. S. T.

Photometric determination of copper and iron in distilled liquors.—See B., 1942, III, 184.

Determination of copper and nickel in steels.—See B., 1942, I, 350.

Separation of ytterbium and accompanying rare earths by means of its amalgam. H. N. McCoy and R. P. Hammond (*J. Amer. Chem. Soc.*, 1942, **64**, 1009).—An extension of previous work (A., 1942, I, 178) with spectroscopic examination of the rare-earth metals from the electrolysed amalgams indicates that Yb can be separated from other rare earths by its amalgam. W. R. A.

Precipitation of aluminium chloride from ether–aqueous hydrochloric acid and its importance in separation operations. W. Fischer and W. Seidel (*Z. anorg. Chem.*, 1941, **247**, 333—366).—The solubility of $AlCl_3,6H_2O$ in mixtures of H_2O and Et_2O saturated with HCl has been determined and the effect of stirring, temp., and the EtO : H_2O ratio has been investigated; at 0° with equal parts of H_2O and Et_2O containing 39% of HCl the solubility was 0·3 mg. Al_2O_3 per 100 ml. of mixture; it decreased as the % Et_2O was increased—at 15° in a 7 : 3 mixture of Et_2O and 6N-aq. HCl the solubility was 0·2. The solubilities of $Na^{·}$, $K^{·}$, $NH_4^{·}$, $Be^{··}$, $Mg^{··}$, $Ca^{··}$, $Ti^{····}$, $V^{····}$, $Cr^{···}$, $Mn^{··}$, $Fe^{···}$, $Co^{··}$, $Ni^{··}$, $Cu^{··}$, and $Zn^{··}$ at 0° in 1 : 1 Et_2O–H_2O mixtures saturated with HCl (~39%) have also been determined and the solubilities, which were all ≫ that of $Al^{···}$, and colours of the solutions are given. The wt. of impurity carried down when 100 mg. of Al was pptd. from 100 ml. of Et_2O–H_2O–HCl in presence of 1000, 100, 10, and 1 mg. of other mixed substances was determined and in most cases was extremely small (<1%); the method has been extended to the separation of Ni from Fe and Co. The results of the method are compared with the results obtained by pptn. with aq. NH_3, and its importance in quant. analysis is discussed. J. L. E.

Qualitative reagents for cations. V. Reagents for rhenium cations and perrhenic anions. P. Wenger and R. Duckert (*Helv. Chim. Acta*, 1942, **25**, 599—604).—Reagents for $Re^{···}$ and $ReO_4^{·}$ are classified. C. R. H.

Quantitative control tests for ferric iron added to flour.—See B., 1942, III, 184.

Oxidimetric determination of niobium alone and in the presence of iron, vanadium, and titanium. W. D. Treadwell and R. Nieriker (*Helv. Chim. Acta*, 1942, **25**, 474—488).—Using an improved form of electrolytic reduction vessel it has been shown that Nb^{V} in M-H_2SO_4 can be reduced quantitatively to Nb^{III} at an amalgamated Pb cathode using a c.d. of ~5 amp. per sq. dm. In this solution the Nb^{III} can be titrated electrometrically with $KMnO_4$ or $FeCl_3$, or, with less accuracy, with $K_2Cr_2O_7$, even in presence of $Fe^{··}$, $Ti^{···}$, of $V^{··}$. In M-H_3PO_4 Nb^{V} is not reduced at a Cd cathode, whereas Ti^{IV}, V^{V}, and Fe^{III} are all reduced under these conditions. This method permits the determination of these metals in presence of Nb. J. W. S.

XI.—APPARATUS ETC.

Methods of photographic stellar photometry. M. de Saussure (*Ann. Guébhard-Séverine*, 1940—41, 259—274).—Multiple images of known intensity ratio are formed on the photographic plate by means of two half-aluminised glass plates at a small angle. O. D. S.

Logarithm-of-wave-length scale for use in absorption spectrophotometry. W. A. Shurcliff (*J. Opt. Soc. Amer.*, 1942, **32**, 229—233).—Advantages are indicated, and a system providing 100 units per spectral octave is described. N. M. B.

Interference spectroscopy. (A) II. (B) Errata. K. W. Meissner (*J. Opt. Soc. Amer.*, 1942, **32**, 185—210, 211; cf. A., 1942, I, 27).—(A) A description of the principles of the compound interferometer, multiplex interference spectroscope, and reflexion echelon diffraction grating and of their applications to absorption spectra, half widths, and intensity distributions.

(B) Corrections to I. N. M. B.

Streaming double refraction in absorbing and [optically] active solutions. I. Methods of measurement. Y. Björnståhl (*Kolloid-Z.*, 1941, **97**, 46—53).—Mathematical. A method is given for obtaining the consts. that characterise the emergent light after traversing a streaming doubly refracting solution of an optically active substance. F. L. U.

Mercury sensitisation and the optical and *X*-ray latent images. A. May (*J. Opt. Soc. Amer.*, 1942, **32**, 219—223).—Results of a study of the speed factors of films sensitised before and after exposure are plotted and discussed. N. M. B.

Use of Elkonite for cyclotron ion sources. B. R. Curtis and R. S. Bender (*Rev. Sci. Instr.*, 1942, **13**, 266).—Elkonite (W–Cu; 10W3 grade), when used instead of Cu for the arc capillary, prolongs the life of the capillary ≮3-fold. A. A. E.

Complete proportional counter arrangement for cosmic-ray measurements. P. Weisz and W. E. Ramsey (*Rev. Sci. Instr.*, 1942, **13**, 258—264).—Apparatus is described and figured, and certain general principles of proportional counter mechanism are discussed. A. A. E.

Operating characteristics of the Wilson cloud chamber. W. E. Hazen (*Rev. Sci. Instr.*, 1942, **13**, 247—257).—$p_{min.}$ and the initial pressure rise after completion of expansion $\propto t^{\frac{1}{2}}$ (t = expansion time); the ion threshold expansion ratio and the surface area of a drop increase linearly with t. The sensitive time increases with expansion ratio, is max. when the general background becomes appreciable, and approaches zero for higher expansion ratios. A. A. E.

Electrical method for the instantaneous determination of traces of gases in air. E. Huguenard (*Compt. rend.*, 1941, **213**, 21—23).—The method depends on variation of resistance of a Pt wire heated in pure and in impure air. It is possible to determine the proportions of two impurities. The EtOH content of a liquid can be found by aspirating some of the atm. from above the liquid, and analysing it by the above method. A. J. M.

Hot-stage hypermicroscopy with the electron microscope. M. von Ardenne (*Kolliod-Z.*, 1941, **97**, 257—272).—The construction and use of heating stages for use with the author's electron microscope (cf. A., 1940, I, 376) are described; the stages are calibrated by a micro-pyrometer. By using different metals, temp. up to 3000° can be reached. The effect of heat was thus investigated on (*a*) Zn foil, (*b*) an Al splinter, (*c*) a metal powder of high m.p., (*d*) an uncrystallisable powder of high m.p., and (*e*) spores of *B. vulgatus*. The possible applications of this new technique are discussed. N. G.

Distillation. W. Kuhn (*Helv. Chim. Acta*, 1942, **25**, 252—295).—Mathematical. The effects of various factors on the efficiency of a simple reflux fractionating column are evaluated and the optimum conditions for the operation of such a column are deduced. J. W. S.

Sealing quartz windows on Pyrex tubes. S. W. Benson (*Rev. Sci. Instr.*, 1942, **13**, 267—269).—Procedure whereby the bevelled end of a Pyrex tube is platinised and then sealed to a quartz window by means of fused AgCl is described. A. A. E.

Sealing mica to glass or metal to form a vacuum-tight joint. J. S. Donal, jun. (*Rev. Sci. Instr.*, 1942, **13**, 266—267).—Powdered Pb borosilicate glass of low m.p., mixed with H_2O, is painted on the surfaces to be sealed, and the parts are heated in an oven at ~600°. A. A. E.

Black-enamelled basins. A. G. Arend (*Paint Tech.*, 1942, **7**, 41).—The use of black surfaces enhances the visibility of ppts. E. F. P.

Alignment chart for computation of ultracentrifugation results.—See A., 1942, III, 656.

Determination of viscosity with the turboviscosimeter.—See B., 1942, I, 323.

XIII.—GEOCHEMISTRY.

Calcium content of some East Australian waters.—See A., 1942, III, 695.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

OCTOBER, 1942.

I.—SUB-ATOMICS.

Anomaly in the spectrum of O^{++}. (Miss) B. Jeffreys (*Proc. Camb. Phil. Soc.*, 1942, **38**, 290—295).—Hartree's and Stevenson's corrections to O^{++} wave-functions are inadequate to account for the discrepancy between observed and calc. vals. of the intermultiplet separations $(^1D—^1S)/(^3P—^1D)$ for the $(1s)^2\ (2s)^2\ (2p)^2$ configuration. L. J. J.

First spark spectrum of cæsium (Cs II). M. A. Wheatley and R. A. Sawyer (*Physical Rev.*, 1942, [ii], **61**, 591—600).—Electrodeless discharge spectrograms in the region λλ 2954·07—1857·45 confirm the classifications of Laporte (cf. A., 1932, 439) and of Olthoff (cf. A., 1933, 200) and lead to extensions. Full data are tabulated, 37 levels are established, and 189 lines classified. Results agree with theory and with predictions from Xe I classification. N. M. B.

Hyperfine structure of Cs II. R. A. Boyd and R. A. Sawyer (*Physical Rev.*, 1942, [ii], **61**, 601—605; cf. preceding abstract).—The hyperfine structures of 13 lines were measured and 12 of the patterns were analysed and identified as due to transitions between the $5p^5(^2P_{1/2})6p$ terms and the $5p^5(^2P_{1/2})5d$, 6*s*, 6*d*, 7*s* and the $5p^5(^2P_{3/2})7d$, 8*s* terms. *J* vals. and interval factors are verified or established. N. M. B.

Spectra of Hg II and Hg III. S. Mrozowski (*Physical Rev.*, 1942, [ii], **61**, 605—613; cf. A., 1940, I, 138).—Many lines in the region 6000—2200 A. show fine structures, which are given in graphs. Isotope shifts in 47 levels of Hg II and hyperfine structure separations in 10 of them, as well as data for classified and unclassified lines, are tabulated. The correctness of available vals. for certain classifications and term vals. is examined. Lines of large isotope shift indicate two previously unknown sets of levels in Hg II belonging to configurations $5d^8\,6s^2nx$ and $5d^9nx\,n'x'$. N. M. B.

Zeeman effects in the spectrum of singly ionised nickel. C. H. Lindsley (*J. Opt. Soc. Amer.*, 1942, **32**, 387—389; cf. A., 1942, I, 221).—Zeeman data for 128 Ni II lines (2165—4067 A.) in fields of 85,700 and 81,300 gauss are tabulated. *g* vals. are determined for the even energy levels arising from the $3d^8\,4s$ and from some $3d^8\,5s$ configurations, and for many odd levels arising from the $3d^8\,4p$ configurations. N. M. B.

Interference spectroscopy.—See A., 1942, I, 308.

Interaction of atomic energy levels. V. T. S. Subbaraya, S. Yusuff, and S. S. Murthy. **VI.** T. S. Subbaraya, K. Seshadri, and N. A. N. Rao (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 244—249, 250—257).—V. An extension of previous work (A., 1941, I, 285) to HgS.

VI. The mutual influence of Hg and Pb on the spectrum of their mixtures has been studied by comparison of the spectra of the metals alone and in admixture. W. R. A.

Absolute *f* values for lines of Fe I. R. B. King (*Astrophys. J.*, 1942, **95**, 78—81).—Abs. *f* vals. are obtained by the method of total absorption for 12 lines in two multiplets, a^5D–z^5D^o and a^5D–z^5F^o, from the ground state of Fe I. They are ~0·01, and are $1{\cdot}85 \times 10^{-4}$ times the relative *f* vals. previously given (A., 1938, I, 219). E. R. R.

Abundance of iron in the sun. R. B. King (*Astrophys. J.*, 1942, **95**, 82—87).—The total no. of neutral Fe atoms per sq. cm. in the solar reversing layer, calc. from abs. *f* vals. of strong lines of Fe I and equiv. solar widths, is $4{\cdot}3 \times 10^{18}$, assuming the excitation temp. to be 4400°. E. R. R.

Characteristic radial motions of Hα absorption markings seen with bright eruptions on the sun's disc. H. W. Newton (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 2—10). W. J.

Motions of hydrogen flocculi by Doppler displacements of the Hα line. M. A. Ellison (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 11—21). W. J.

Bright lines of the solar corona and the Stark effect in helium. J. Gauzit (*Compt. rend.*, 1941, **213**, 770—772).—A theory attributing the lines to a Stark effect in He is proposed and discussed. N. M. B.

Spectrographic observations at the total eclipse of Oct. 1, 1940. I. Instrument and observational procedure. II. The flash spectrum and atomic velocities in the chromosphere. R. O. Redman (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 134—139, 140—151). W. J.

Ultra-violet solar and sky radiation intensities in high latitudes. W. W. Coblentz, F. R. Gracely, and R. Stair (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 581—591).—Continuous photo-electric records are given of the abs. intensity of the biologically effective radiation, of $\lambda > 3200$ A., from the sun and the entire sky, incident on a horizontal plane, under various meteorological conditions, in latitudes up to 78·3° N. As was expected from the distribution of O_3 in the stratosphere with latitude and season, the ultra-violet intensities at latitude 78° N. appear to be higher than at 62° N., but lower than at 39° N. for the same solar altitudes. At noon on the clearest mid-summer days at 78° N. the ultra-violet solar and sky radiation range in intensity from 30 to 40 μw.-sec. per sq. cm., a biologically significant val. of special interest in connexion with the incidence of rickets. W. J.

Interstellar matter. C. S. Beals (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 96—106).—A progress report. W. J.

Quantitative studies of spectrograms of Nova Lacertæ 1936. P. Rossier (*Arch. Sci. phys. nat.*, 1941, [v], **23**, 233—248).

Radial velocity curve of δ Cephei. H. A. Brück and H. E. Green (*Month. Not. Roy. Astr. Soc.*, 1942, **101**, 376—380). W. J.

Profiles of hydrogen lines in two class-B stars. A. V. Douglas and D. C. West (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 35—39). W. J.

Some recent changes in the spectrum of γ Cassiopeiæ. E. M. Peachey (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 166—168). W. J.

Spectra of Wolf–Rayet stars and related objects. P. Swings (*Astrophys. J.*, 1942, **95**, 112—133).—From new observations, evidence of C IV in the *WN* sequence and for a central reversal of the H, He I, and He II lines is given. The significance of the relative abundances of C and N in the ejected shells of Wolf-Rayet, *Of*, and *P* Cygni stars and of novæ is discussed. E. R. R.

Extended stellar atmospheres: a review of the problems of gaseous shells. O. Struve (*Astrophys. J.*, 1942, **95**, 134—151). E. R. R.

Spectrographic observations of peculiar stars. HI. P. Swings and O. Struve (*Astrophys. J.*, 1942, **95**, 152—160).—Recent changes in the spectra of *AX* Per, *Z* and *AG* Peg, and *R* Aqr, and the recent spectrogram of *MWC* 349, are described. E. R. R.

Spectrum of α-Carinæ. J. L. Greenstein (*Astrophys. J.*, 1942, **95**, 161—200).—λλ and identifications of nearly 1000 lines and equiv. widths of 300 lines in spectrograms of α-Carinæ are tabulated. Ionised metals and Fe I predominate; strong H lines and lines of C I, N I, S I, and Si II are present. Excitation temp. (4900—6000°), curves of growth for Fe I and for the ionised metals, ionisation temp. (7300°), log P_e (1·0), and abundances of the lighter elements are obtained. E. R. R.

Spectra of α-Cygni and α-Lyræ in the region λλ 3000—3300 A. J. H. Rush (*Astrophys. J.*, 1942, **95**, 213—217).—λλ, intensities, and identifications of absorption lines are tabulated. E. R. R.

Rotation of the spiral nebula Messier 33. N. V. Mayall and L. H. Aller (*Astrophys. J.*, 1942, **95**, 5—23). E. R. R.

Spectra of the emission nebulosities in Messier 33. L. H. Aller (*Astrophys. J.*, 1942, **95**, 52—57).—The intensity ratio of λ 5007/λ 3727 is the most reliable excitation criterion for the emission nebulosities. O appears to be predominant as O^+. E. R. R.

Intensity anomalies in α-Cygni. L. H. Aller (*Astrophys. J.*, 1942, **95**, 73—75).—Interlocking or emission arising from chromospheric effects may explain observed deviations of lines of Cr II and Ti II from the curve of growth determined by Fe II atoms. E. R. R.

Continuous *X*-ray spectrum. R. Weinstock (*Physical Rev.*, 1942, [ii], **61**, 584—590).—The theory of continuous *X*-ray radiation from thin targets (neglecting relativity and retardation of potential) is completed by the incoherent integration of the single-process transition probabilities over the unit sphere. Comparison with the abs. intensity determination of Smick and Kirkpatrick (cf. *ibid.*, 1941, [ii], **60**, 162) gives a result too large by a factor >2·5. The theory compares satisfactorily with the abs. measurement by Clark and

Kelly (cf. *ibid.*, **59**, 220), and the relative measurements by Harworth and Kirkpatrick (cf. *ibid.*, **60**, 163). N. M. B.

Statistical treatment of the Röntgen-ray transmission of many similar layers. M. von Laue (*Naturwiss.*, 1942, **30**, 205—207).—The X-ray transmission photograph taken through many layers (of cloth) can give no information as to the structure of the components of the single layer. O. D. S.

Excitation of the anode effect. P. L. Copeland and G. G. Carne (*Physical Rev.*, 1942, [ii], **01**, 635—642; cf. *ibid.*, 1940, [ii], **57**, 625).—A study of the accumulation of charges in the anode effect is reported and interpretations of results are suggested. The effects are ascribed to a surface of Th on O on Ni. Computations on electron-capture probability are given and discussed. N. M. B.

Total secondary electron emission from thin sodium films on tungsten. K. G. McKay (*Physical Rev.*, 1942, [ii], **61**, 708—713).—Data are compared with those for a clean W target with 100—1200-v. primary electron energies. The secondary emission yield δ increased as the work function of the surface was decreased by addition of Na. As Na was evaporated off the W δ did not fall below that of clean W. When the work function was increased by forming an air film on clean W, δ decreased. Results agree with theory and with available data. N. M. B.

Secondary emission from antimony films deposited by evaporation. P. Görlich (*Physikal. Z.*, 1942, **43**, 121—123).—The secondary emission depends on the thickness of the film and the nature of the underlying base. It is const. for films of thickness <380 mμ. If an Sb film is left in air for some time the secondary emission decreases considerably. A. J. M.

Vibratory electron in electrostatics. E. T. Jones (*Phil. Mag.*, 1942, [vii], **33**, 519—527). L. J. J.

Practical range of secondary electrons from X-rays similar to rays from radium. B. Hess and R. Jaeger (*Physikal. Z.*, 1942, **43**, 117—120).—The max. range of secondary electrons from 1000-kv. X-rays of λ 25—12·3 X. is $\ll$ that of those produced by radiation from Ra-C. The results agree satisfactorily with those obtained by quantum-mechanical theory. A. J. M.

Hot-stage hypermicroscopy with the electron microscope.—See A., 1942, I, 308.

Ionisation in the hydrogen convection zone [of the sun]. M. Schwarzschild (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 152—153).—Sequel to Eddington (*ibid.*, 1941, **101**, 177); see also following abstract. W. J.

Conditions in the hydrogen convection zone [of the sun]. (Sir) A. S. Eddington (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 154—158).—Reply to Schwarzschild (preceding abstract). W. J.

Current density at the cathode of a glow discharge through gases. R. M. Chaudhuri and M. A. Baaqui (*Current Sci.*, 1942, **11**, 188—189).—C.d., measured at 0·33—0·02 mm. Hg, 365—2990 v., and 0·25—9·5 ma., by rotating a fine hole in a cylinder closely fitting into the cathode, is uniform over a central region of the latter, the dimensions of which depend mainly on pressure. Aston's relation $V = E + (F\sqrt{C})/P$ holds for low pressures. E. R. R.

Operating characteristics of the Wilson cloud chamber.—See A., 1942, I, 308.

Measurement of initial inner permeability of iron over a wide radio-frequency range. R. W. Woods (*J. Appl. Physics*, 1942, **13**, 314—319).—An improved method and apparatus are described. A. J. M.

At. wt. comparisons from density and X-ray data: fluorine, calcium, and carbon. C. A. Hutchison (*J. Chem. Physics*, 1942, **10**, 489—490).—Using the best chemical val., 12·0104, for the at. wt. of C, vals. 40·0842±0·0049 and 18·9961±0·0015 are calc. for at. wts. of Ca and F. L. J. J.

Suggested revision of the seventh period of the periodic table. G. E. Villar (*J. Chem. Educ.*, 1942, **19**, 286). L. S. T.

Isomeric atomic nuclei. E. Stuhlinger (*Naturwiss.*, 1941, **29**, 745—756).—A review. The existence of isomerism in at. nuclei is discussed and explained with special reference to the isomerism of Br and In nuclei. The chemical separation of radioactive isotopes and isomers is considered. Isomerism with two β-labile excitation states is also dealt with. The theory of at. isomerism and empirical relations are considered. A. J. M.

The source of the sun's energy. S. Chapman (*Month. Not. Roy. Astr. Soc.*, 1942, **102**, 110—130).—Presidential address. W. J.

Existence of a neutrino. J. S. Allen (*Physical. Rev.*, 1942, [ii], **61**, 692—697).—The max. energy of recoils produced by $^7Be + e_K \rightarrow {}^7Li + \eta + Q$ (where e_K = a K electron and η = a neutrino) was ~40—50 e.v. compared with the 58 e.v. to be expected for a neutrino of zero rest mass. An attempt to detect coincidences caused by emission in opposite directions of a γ-ray and recoil nucleus gave coincidences $<2\%$ of those expected for γ-ray recoils. Apparently the recoils were caused by the emission of a neutrino and not a γ-ray. N. M. B.

Theoretical half-lives of forbidden β-transitions. E. Greuling (*Physical Rev.*, 1942, [ii], **61**, 568—577; cf. Konopinski, A., 1941, I, 439).—Fermi's theory of β-decay is extended to the "nth forbidden" approximation, and formulæ are derived for the energy distribution of the emitted β-rays according to the 5 possible invariant forms of interaction. Experimental half-lives of the "forbidden" β-decays of Ra-E, ^{32}P, ^{40}K, and ^{87}Rb are compared with calc. vals., and accord best with those obtained by the tensor form of interaction. N. M. B.

β-Ray spectra of scandium. G. P. Smith (*Physical Rev.*, 1942, [ii], **61**, 578—583).—The positron spectrum of ^{44}Sc and the electron spectrum of ^{48}Sc, measured by a high-resolution spectrometer, show max. energies 1·45±0·01 Me.v. and 640±4 ke.v., respectively. A Kurie plot shows that neither spectrum satisfies the Fermi distribution for an "allowed disintegration." The positron decay curve resolves into components of 4 hr. and 52 hr. half-life, due to a 52-hr. γ-ray transition to the 4-hr. ^{44}Sc positron-emitting level. The conversion coeff. of the γ-ray is 0·070±0·012 corresponding with a change of angular momentum of 3 units in the transition. The excitation energy of the γ-ray for deuteron bombardment is 4·0±0·2 Me.v. N. M. B.

Absence of high-energy β-rays from ^{82}Br. M. Deutsch (*Physical Rev.*, 1942, [ii], **61**, 672).—Special experiments give no definite evidence of the existence of the high-energy group reported by Rotblat (cf. A., 1942, I, 4). There is some indication that the effect is to be expected when β-rays are accompanied by γ-rays of energy > the max. energy of the β-rays. N. M. B.

Disintegration schemes of radioactive substances. HI. ^{131}I. J. R. Downing, M. Deutsch, and A. Roberts (*Physical Rev.*, 1942, [ii], **61**, 686—691).—The disintegration of ^{131}I (7·8 days), studied by spectrometer and coincidence methods, shows a simple β-ray spectrum with end-point 0·595±0·01 Me.v. Each β-ray is accompanied by two cascade γ-rays of energies 367±7 and 80±1 ke.v. Both γ-rays are partly internally converted, the 367-ke.v. ray in the K shell in 0·8% of the disintegrations. N. M. B.

Radioactive isotopes of praseodymium. J. W. De Wire, M. L. Pool, and J. D. Kurbatov (*Physical Rev.*, 1942, [ii], **61**, 564—567).—New nuclear reactions $^{141}Pr(d,p)$, $^{142}Ce(p,n)$, and $^{139}La(\alpha,n)$ yielding radioactive ^{142}Pr have been observed; the revised half-life is 19·3±0·1 hr.; the measured end-point of the negative β-ray spectrum is 2·14±0·02 Me.v. A weak γ-ray ~1·9 Me.v. is associated with ^{142}Pr. ^{140}Pr is formed by the reaction $^{141}Pr(n,2n)$; the measured half-life is 3·4±0·1 min.; the upper limit of its positron spectrum is 2·40±0·15 Me.v. N. M. B.

Complete proportional counter arrangement for cosmic-ray measurements.—See A., 1942, I, 308.

Spatial and angular distribution of particles in cosmic-radiation showers in air. G. Molière (*Naturwiss.*, 1942, **30**, 87—89).—The disagreement between the vals. for the spatial and angular distribution of particles calc. by Euler and Wergeland (*Astrophys. Norweg.*, 1940, **3**, 165) and Landau (*J. Physics*, 1940, **3**, 237) respectively is due both to numerical errors in Landau's calculations and the importance of some factors neglected by Euler and Wergeland. The calculations of the latter are repeated allowing for those factors. O. D. S.

Electric and magnetic effects of cosmic rays. F. Evans (*Physical Rev.*, 1942, [ii], **61**, 680—683; cf. A., 1941, I, 95).—Mathematical. N. M. B.

Nature of the soft component of cosmic rays at 3500 metres altitude. P. V. Auger (*Physical Rev.*, 1942, [ii], **61**, 684—685). N. M. B.

Multiple secondary effects of the penetrating cosmic radiation at sea level. P. Auger amd J. Daudin (*Physical Rev.*, 1942, [ii], **61**, 549—556). N. M. B.

Cloud-chamber photographs at 4310 metres altitude. W. H. Bostick (*Physical Rev.*, 1942, [ii] **61**, 557—564).—Out of 2983 expansions, 5·8% showed particles classified as slow mesotrons or slow protons, 1·3% showed particles with sp. ionisation increasing markedly on passing through a 1·3-cm. Pb plate, 27 showed penetrating pairs indicating the production of penetrating secondaries at this altitude, 5 showed electrons from possible mesotron disintegrations in the chamber, and some gave evidence for nuclear processes associated with showers. N. M. B.

Stars and slow protons at 14,125 feet. W. M. Powell (*Physical Rev.*, 1942, [ii], **61**, 670—671).—A description and discussion of various phenomena, and their energy factors, observed in a cloud chamber containing five 1-cm. horizontal Pb plates 6 cm. apart. N. M. B.

Mesotron lifetime. B. Rossi, K. Greisen, J. C. Stearns, D. K. Froman, and P. G. Koontz (*Physical Rev.*, 1942, [ii], **61**, 675—679).—The measured average ranges before decay of two mono-energetic mesotron groups are, as theoretically predicted, in the same ratio as the average effective momenta. Calc. vals. of τ_0 are (2·8±0·3) × 10^{-6} and (2·9±0·7) × 10^{-6} sec. for the proper lifetime, in good agreement with previous measurements (cf. A., 1941, I, 190). N. M. B.

Influence of radiation damping on the scattering of mesons. II. Multiple processes. W. Heitler and H. W. Peng (*Proc. Camb. Phil. Soc.*, 1942, **38**, 296—312; cf. A., 1941, I, 361).—Simplified field equations are applied to multiple processes, *e.g.*, meson–nuclear particle collisions. L. J. J.

Theory of successive radioactive transformations. W. F. Sedgwick (*Proc. Camb. Phil. Soc.*, 1942, **38**, 280—289).—Algebraical proofs of formulæ for the amounts of individual products as a function of time are given. L. J. J.

Virtual state of the deuteron. L. Hulthén (*Physical Rev.*, 1942, [ii], **61**, 671).—Mathematical. N. M. B.

II.—MOLECULAR STRUCTURE.

Spectra of comets 1941*c* (Paraskevopoulos-de Kock) and 1941*d* (van Gent). C. T. Elvey, P. Swings, and H. W. Babcock (*Astrophys. J.*, 1942, **95**, 218—219).—Relative intensities of observed lines of C_2, CN, CH, OH, and NH are reported and discussed. E. R. R.

Band spectrum and structure of the CH^+ molecule; identification of three interstellar lines. A. E. Douglas and G. Herzberg (*Canad. J. Res.*, 1942, **20**, **A**, 71—82).—The spectrum of a discharge through He containing a trace of C_6H_6 contains a band system of the type $^1\Pi \rightarrow {}^1\Sigma$ attributable to the CH^+ mol. The $R(0)$ lines of the $0 \rightarrow 0$, $1 \rightarrow 0$, and $2 \rightarrow 0$ bands coincide with the previously unidentified interstellar lines at 4232·58, 3957·72, and 3745·33 A., respectively, proving the presence of CH^+ in interstellar space. The physical consts. of the mol. are derived. J. W. S.

Selective excitation of spectra by the high-frequency discharge. R. K. Asundi and N. L. Singh (*Nature*, 1942, **150**, 123).—Phenomena already reported (*Proc. Indian Sci. Cong.*, 1942, *Part* 3, 35) consist essentially in a redistribution of intensity among different band-systems of a diat. mol. or among at. energy states of different multiplicities. All the facts have been correlated with the form of the excitation function wherever this is known. A. A. E.

Nature of reactions occurring in the production of the afterglow of active nitrogen and the effect of temperature on the phenomena. D. E. Debeau (*Physical Rev.*, 1942, [ii], **61**, 668—669).—A picture of the mechanism, according with available data, is based on Thomson's observation which indicated that one component of active N_2 was frozen out at liquid-air temp. The explanation agrees with temp. and pressure observations. N. M. B.

Sulphur monoxide. IX. Absorption spectrum. P. W. Schenk (*Z. physikal. Chem.*, 1942, **B**, **51**, 113—119).—The chemical behaviour of SO lends no support to the existence of a metastable S_2 mol. postulated for the interpretation of the absorption spectrum. W. R. A.

Structure of the carbonyl sulphide molecule. A. Eucken and K. Schäfer (*Z. physikal. Chem.*, 1941, **B**, **51**, 60—61, 126).—Calculation of the mol. sp. heat of COS from measurements of the ultrasonic dispersion (A., 1942, I, 49) confirms the linear model for the COS mol. and does not agree with the non-linear model of Wagner (A., 1942, I, 165). O. D. S.

Excitation of organic molecules by electron impact in the glow discharge. H. Schüler and A. Woeldike (*Physikal. Z.*, 1941, **42**, 390—399; cf. *ibid.*, 1940, **41**, 381).—A discharge tube for production of emission spectra of org. substances is described; H_2 or a rare gas is used as a "carrier." Methods are given for excitation of spectra by electron impact on undecomposed mols. or on the decomp. products. The results are better than those obtained with a Tesla discharge. Typical spectra for C_6H_6, PhCN, PhCl, PhBr, $COMe_2$, and COPhMe are illustrated and discussed. The emission and absorption spectra correspond only partly, and the comparison affords a new method for prediction of the form of potential energy curves of unexcited and excited org. mols. A. J. E. W.

Infra-red spectra of hydrocarbons. I. Temperature-dependence of absorption bands. W. H. Avery and C. F. Ellis (*J. Chem. Physics*, 1942, **10**, 10—18).—The proportionality of the separation of the max. of *P* and *R* branches of a band to $T^{1/2}$ holds approx. for C_2H_6, C_3H_6, and $EtBu^\gamma$ between room temp. and −195°. In the liquid state the observed separations are < theoretical vals. and in the solid state still less. The positions of the bands are not greatly affected by temp. but some bands of C_3H_6 exhibit marked variation in relative intensity with temp. Spectra at low temp. help in the assignment of fundamentals, in studying the liquid state, and in analysis. W. R. A.

Infra-red spectra of axially symmetrical XY_2Z molecules. I. Vibration-rotation energies. W. H. Shaffer (*J. Chem. Physics*, 1942, **10**, 1—9).—Mathematical. Vibration-rotation energies are expressed as $E = hc(G_V + F_R - F_C)$ where G_V, F_R, and F_C are the vibrational, rotational, and Coriolis terms. W. R. A.

Vibrational spectrum of pyrrole and its deuterium derivatives. R. C. Lord, jun., and F. A. Miller (*J. Chem. Physics*, 1942, **10**, 328—341).—Examination of Raman and infra-red absorption (750—1900 cm.$^{-1}$) spectra of pyrrole and its mono-, tetra- (symmetrical), and penta-deuterated derivatives, in conjunction with selection rules and Teller's product theorem, suggests a C_{2v} structure but does not completely exclude a C_s structure. W. R. A.

Absorption spectrum of silicon, tin, and lead tetraphenyls. G. Milazzo (*Gazzetta*, 1941, **71**, 73—81).—Absorption spectra of $SiPh_4$, $SnPh_4$, and $PbPh_4$ in $CHCl_3$ and in EtOH are recorded and discussed. E. W. W.

Absorption spectra of 3 : 4-benzpyrene. F. Weigert (*Nature*, 1942, **150**, 56).—The first broad absorption band of dissolved benzpyrene (**I**) has components at 383, 380, and 377 mμ. in *cyclo*hexane; ortho-rhombic (**I**) shows a band between 415 and 425 mμ. with narrower bands at 405—410, 392—396, and 384—387 mμ. The absorption spectrum of monoclinic (**I**) has been recorded by an indirect method (Bowen and Sawtell); a fluorogram of a colloidal suspension of (**I**) in H_2O is also reproduced. A. A. E.

Light absorption and constitution of chlorophyll derivatives. II. F. Pruckner (*Z. physikal. Chem.*, 1940, **A**, **187**, 257—275; cf. A., 1938, I, 10).—The absorption spectra of various porphyrin and chlorin derivatives in dioxan, $COMe_2$, CCl_4, C_6H_{14}, and C_5H_5N have been measured in the visible range. The results are tabulated and graphed, and are discussed in relation to the structures. J. W. S.

Influence of addition of foreign substances on the luminescence of lucigenin. II. K. Weber and W. Ochsenfeld (*Z. physikal. Chem.*, 1942, **B**, **51**, 63—74).—Increase in the concn. of NaOH produces a strong increase in initial brightness and, to a smaller extent, in the total light of lucigenin (**I**). Increased concn. of H_2O_2 causes a linear increase in initial brightness of luminescence. The effects of other substances [$(CH_2{\cdot}OH)_2$, glycerol, $CO(NH_2)_2$, thiosinamine, ascorbic acid, salicylic acid, nicotine salicylate, and pyrogallol] are discussed. The possibility of a sensitised chemiluminescence in solutions containing (**I**) and luminol (**II**) is theoretically discussed and experiments have shown that in such systems probably two kinds of substances exist, one transferring the excitation energy of the (**II**) mol. to the (**I**), and the other not detectable because of the excitation of the (**I**). W. R. A.

Lattice and electronic spectrum of diamond. P. G. N. Nayar (*Proc. Indian Acad. Sci.*, 1942, **15**, **A**, 293—309).—Fluorescence and absorption spectra split into discrete lines at liquid-air temp., enabling $\nu\nu$ of fundamental vibrations of the diamond lattice to be derived, and show perfect mirror-image symmetry about the band at 4152 A. The discrete character of the derived lattice spectrum postulates that at. oscillations in a simple cryst. solid are of a different nature from those of an elastic solid. The 4152 A. line is a doublet in absorption; many lines between 3015 and 3447 A. are listed and an unresolved group at <3000 A. The influence of temp. on the absorption spectrum has been investigated. W. R. A.

Luminescence, absorption, and scattering of light in diamonds. IV. Raman effect. P. G. N. Nayar (*Proc. Indian Acad. Sci.*, 1942, **15**, **A**, 310—315).—Investigation of the frequency, intensity, and polarisation of the Raman ν 1332 cm.$^{-1}$ reveals that crystal setting has no influence and that the depolarisation val. is 1, not 2 as obtained theoretically. W. R. A.

Photo-electric detection and intensity measurement in Raman spectra. D. H. Rank, R. J. Pfister, and P. D. Coleman (*J. Opt. Soc. Amer.*, 1942, **32**, 390—396).—A description of apparatus, technique, and preliminary photo-electric measurements of Raman intensities. N. M. B.

Polarisation measurements of Raman lines. G. Glockler and H. T. Baker (*J. Chem. Physics*, 1942, **10**, 404).—A modified method of measuring the depolarisation factor of Raman lines by a fixed polaroid is described. W. R. A.

Structure of the additive compound of aluminium chloride and sulphur dioxide. H. Gerding and E. Smit (*Z. physikal. Chem.*, 1942, **B**, **51**, 200—216).—Raman spectral data are most easily compatible with the double formula $Al_2Cl_6,2SO_2$. W. R. A.

Raman spectrum of liquid aluminium bromide. H. Gerding and E. Smit (*Z. physikal. Chem.*, 1942, **B**, **51**, 217—218).—Polemical against Rosenbaum (A., 1940, I, 403). W. R. A.

Fluorescence of uranyl compounds and the Raman spectrum of the uranyl ion. B. S. Satyanarayana (*Proc. Indian Acad. Sci.*, 1942, **15**, **A**, 414—416).—The Raman displacements of saturated UO_2Cl_2 are 211 (doublet), 865 (polarised, faint companion), and 909 cm.$^{-1}$ $UO_2^{\cdot\cdot}$ has a symmetrical bent structure. 865 cm.$^{-1}$ coincides with the ν separation of the fluorescence bands in the solid. W. R. A.

Raman spectrum of single naphthalene crystals. T. M. K. Nedungadi (*Proc. Indian Acad. Sci.*, 1942, **15**, **A**, 376—389).—The Raman spectrum of single crystals of $C_{10}H_8$ has been investigated for different crystal settings and directions of incident and scattered radiation. Six low-frequency lattice oscillations, in agreement with group-theory predictions, are reported. Intensity and polarisation data are discussed. W. R. A.

Raman spectra of dialkyl ketones. F. F. Cleveland, M. J. Murray, J. R. Coley, and U. I. Komarewsky (*J. Chem. Physics*, 1942, **10**, 18—

21).—Displacements, intensities, and depolarisation factors for $COMe_2$, $\beta\zeta$-dimethyl-heptan-δ- and nonan-ε-, tridecan-η-, pentadecan-θ-, and tetradecan-ε-one are given and compared with recorded data. W. R. A.

Raman effect and hydrogen bonds. II. Mixtures of aldehydes and ketones with acceptor solvents. III. Mixtures of acetic acid with water and phenol. IV. Mixtures of acetic acid with donor substances. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 154—159, 230—237, 238—243).—II. Raman spectra of aldehydes and ketones and their mixtures with acceptor solvents such as PhOH, MeOH, EtOH, and $CHCl_3$ support the conclusion (A., 1942, I, 227) that large variations in H-bond strengths exist and depend on the anionoid power of the donor atom and the cationoid power of the acceptor atom. The question of distinguishing between H and OH bonds is discussed. The division into two categories is justified, and a proposal is made to classify them into (1) true H-bonds, and (2) H-bonds. In (1) both the cationoid (C:O) and anionoid (OH) centres are affected, whereas in (2) only the cationoid group indicates change. The influence of constitutive factors on the capacity of C:O compounds to form H-bonds is due to their effect on the strength of the C:O group.

III. Raman spectra of AcOH and several aq. and PhOH solutions of it are discussed from the viewpoint of H-bonding. The breakdown of ring-structure H-bonded dimerides is accompanied by H-bonded hydration to open dimerides and monomerides.

IV. Raman spectra of mixtures of AcOH with ketones and esters show that when the C:O group has strong anionoid properties breakdown of ring dimerides of AcOH to " open " dimerides occurs but is not complete. W. R. A.

Raman spectra of organic compounds : (*a*) aniline ; (*b*) diethyl disulphide ; (*c*) binary liquid mixtures. C. S. Venkateswaran and N. S. Pandya (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 390—395, 396—400, 401—405).—(*a*) The Raman spectrum of NH_2Ph comprises 39 displacements, 30 of which are assigned to the C_6H_6 ring, three to the NH_2, and two to C·N.

(*b*) Et_2S_2 exhibits 27 lines. Their assignment and polarisation are discussed in relation to free rotation.

(*c*) Raman spectra of the mixtures *cyclo*hexane–NH_2Ph (**I**) and $Pr^{\beta}CO_2H$–H_2O have been investigated and compared with those of the components. (**I**) shows no changes. Changes in the position and intensity of 5 lines in $Pr^{\beta}CO_2H$–H_2O are found, and it is concluded that at the crit. solution temp. no dimeric, only monomeric, mols. of $Pr^{\beta}CO_2H$ exist. W. R. A.

Raman effect. CXXXII. Nitrogen compounds. XXI. Structure of acetamide and its compounds. L. Kahovec and K. Knollmüller (*Z. physikal. Chem.*, 1941, **51, B**, 49—59).—The Raman spectra of NH_2Ac,HCl, $2NH_2Ac$,HCl, $Hg(NHAc)_2$, NHAcNa, NaBr + $2NH_2Ac$, NaI + $2NH_2Ac$, KI + $6NH_2Ac$, $MgBr_2$ + $6NH_2Ac$, $MgCl_2$ + $4NH_2Ac$, $CaCl_2$ + $6NH_2Ac$, NH_2Ac cryst. and liquid, and of $(HCO{\cdot}NH)_2Pb$ are described. The structure of the mol. is discussed. O. D. S.

Raman effect. CXXXIII. Nitrogen compounds. XXII. Chloro- and bromo-picrin. Trichloroacetamide. H. Wittek (*Z. physikal. Chem.*, 1942, **B, 51**, 103—112).—Raman spectra of $CBr_3{\cdot}NO_2$ and $CCl_3{\cdot}CO_2K$ have been measured and the degree of polarisation of the lines has been determined. The spectra of $CCl_3{\cdot}CO{\cdot}NH_2$ and $CCl_3{\cdot}NO_2$ (under great dispersion) have been measured. 13 of the 15 vibration forms of the system $CX_3{\cdot}NO_2$ are assigned to observed *νν*. The C_{3v} symmetry of the CX_3 group is not destroyed by substitution of NO_2 nor is the degradation of the vibrations increased. The extra lines in $CCl_3{\cdot}NO_2$ at high *νν* are not shown by $CBr_3{\cdot}NO_2$; they probably are due to Fermi resonance. The spectra of $CCl_3{\cdot}NO_2$, $CCl_3{\cdot}CO{\cdot}NH_2$, and $CCl_3{\cdot}CO_2'$ are very similar. W. R. A.

Raman effect. CXXXV. Nitrogen compounds. XXIII. Mononitroparaffins. H. Wittek (*Z. physikal. Chem.*, 1942, **B, 51**, 187—199).—Raman spectra of $R{\cdot}NO_2$ (R = Me, Et, Pr^{α}, Pr^{β}, Bu^{α}) have been investigated and the polarisations of the last four determined. Lines are attributed to chains and CH vibrations. The apparent doubling of the NO_2 valency *ν*, 1380 cm.$^{-1}$, is due to the accidental equality of a CH deformation *ν* with the symmetric valency *ν* of NO_2. W. R. A.

Law of decay of phosphorescence of alkali halide and silicate phosphors. K. Birus and H. Zierold (*Naturwiss.*, 1942, **30**, 63—64).—The rate of decay of the phosphorescence of Zn_2SiO_4–Mn and KCl–Tl has been investigated by a photo-electric method. The curve is hyperbolic over a wide range, but deviations occur after 10 min., for which an explanation is offered. A. J. M.

Fine structure and line shifting in the spectra of chromium phosphors. O. Deutschbein, G. Joos, and J. Teltow (*Naturwiss.*, 1942, **30**, 228).—The difference in λ between the absorption and fluorescence of Cr phosphors (A., 1932, 983) has been confirmed and is ascribed to the existence of fine structure in the absorption band, fluorescence being confined to one component. O. D. S.

Logarithm-of-wave-length scale for use in absorption spectrophotometry.—See A., 1942, **I**, 308.

Theory of absolute reaction rates and the conductivity of hydrocarbons at high field strengths. N. Davidson (*Physical Rev.*, 1942, [ii], **61**, 721).—Results based on Plumley's assumptions (cf. A., 1941, I, 319) are reported. N. M. B.

Refractive index values for potassium bromide. J. W. Forrest (*J. Opt. Soc. Amer.*, 1942, **32**, 382).—The mean temp. coeff. for λλ 6678—4471 and 21·4—34·0° is 0·000044. Data for *n* over λλ 7699—4048 at 26·4° and reduced for 20° are tabulated. N. M. B.

Interferometric studies of light scattering in gases. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 316—321).—Light scattered backwards by H_2, N_2, O_2, and CO_2 at high pressures has been analysed by a Fabry–Perot interferometer. None of the gases exhibits displaced components similar to those in liquids. The Doppler broadening is too small for the heavier gases to be detectable with Hg radiations. The pattern obtained for H_2 shows a broadening and the half-breadth of the line is approx. that expected from a Maxwell distribution of velocities. A weak background to mols. having high velocities is observed in all scattered patterns. W. R. A.

Interferometric studies of light scattering in mobile liquids. C. S. Ventakeswaran (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 322—337).—The spectral character of the monochromatic light, using 4680, 4722, and 4810 A. of Zn, is investigated interferometrically for dustless CCl_4, Et_2O, EtOH, H_2O, $Pr^{\beta}CO_2H$, $COMe_2$, C_6H_6, PhOH, *cyclo*hexane, and tetralin. Besides two Brillouin components and an undisplaced central component, a continuum extending between these components exists and is most intense in liquids of low b.p., becomes less intense at high temp., and is more intense as the mobility of the liquid is greater. Polarisations and the ratio of the intensity of the central component to that of the Brillouin components have been studied. W. R. A.

Scattering of light in liquids. K. S. Bai (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 338—348).—Existing theories of the intensity of transversely scattered light by liquids are examined. A general expression for the intensity is derived from thermodynamic principles. Abs. intensities of light scattered are given for C_6H_6, CS_2, $CHCl_3$, Et_2O, H_2O, MeOH, EtOH, $Pr^{\alpha}OH$, $Pr^{\beta}OH$, $Bu^{\alpha}OH$, and $Bu^{\beta}OH$; they agree more closely with derived adiabatic than isothermal vals. W. R. A.

Interferometric studies of light scattering in the alcohols. K. S. Bai (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 349—356).—The spectral character of the so-called " unmodified " light scattering by MeOH, EtOH, $Pr^{\alpha}OH$, $Pr^{\beta}OH$, $Bu^{\alpha}OH$, $Bu^{\beta}OH$, *iso*-$C_5H_{11}{\cdot}OH$, and allyl alcohol, examined interferometrically, shows that the intensity of the central component relatively to the outer or displaced components increases rapidly for higher members of the series and indicates that this increase is correlatable with *η*. Observed hypersonic velocities do not differ from ordinary acoustic velocities for these liquids. W. R. A.

Interferometric studies of light scattering in liquids. Polarisation data. K. S. Bai (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 357—361).—The states of polarisation of the central component and the Brillouin components in the light scattering of HCO_2H, AcOH, $Pr^{\alpha}CO_2H$, $Pr^{\beta}CO_2H$, CS_2, $CHCl_3$, C_6H_6, and *cyclo*hexanol have been investigated by means of a Lummer plate and are discussed. W. R. A.

Interferometric studies of light scattering in viscous liquids and glasses. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 362—370).—A detailed account of work already noted (A., 1938, I, 504 ; 1939, I, 9, 451). W. R. A.

Interferometric studies of light scattering. " Hypersonic " velocities in liquids. C. S. Venkateswaran (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 371—375).—" Hypersonic " velocities calc. from Brillouin displacements for 18 liquids have been compared with experimental ultrasonic vals. W. R. A.

Scattering of light in emulsions. D. Singh (*Proc. Indian Acad. Sci.*, 1942, **A, 15**, 406—413).—For dil. emulsions light scattered in the transverse horizontal direction is generally elliptically polarised, whereas the scattered light from conc. emulsions is highly depolarised. W. R. A.

Polarisation of light scattered by isotropic opalescent media. F. Perrin (*J. Chem. Physics*, 1942, **10**, 415—427).—A general theory of polarisation of light scattered by isotropic media having elements of heterogeneity which are not very small in comparison with λ. L. J. J.

Optical dispersion of copper and beryllium. M. P. Givens (*Physical Rev.*, 1942, [ii], **61**, 626—630).—By observing the state of polarisation of linearly polarised light after reflexion from the metal surfaces evaporated on glass, the optical consts. of Cu and Be are measured over the range 2200—9800 A. The absorption band near 5000 A., usually attributed to Cu, was not found and is probably due to CuO. In the Be spectrum a strong absorption band was found near 3000 A. N. M. B.

Magneto-optical properties of ferromagnetic suspensions. H. Mueller and M. H. Shamos (*Physical Rev.*, 1942, [ii], **61**, 631—634).—The change of light transmission through magnetite suspensions under alternating magnetic fields shows that the orientation of the

particles is not exclusively of dipolar origin, as was assumed by Heaps (cf. A., 1940, I, 254) and Elmore (cf. A., 1942, I, 44). Fields of ν 500—15,000 cycles per sec. produce a steady change of absorption; in fields of lower ν the change consists of a steady and a fluctuating part. The wave-form of the latter was studied with a photo-cell amplifier and an oscillograph; in general, it is given by $A \cos \nu t + B \cos 2\nu t$. By varying the field intensity or ν or η, either A or B can be made to vanish. N. M. B.

Basis of stereochemistry. W. H. Mills (*J.C.S.*, 1942, 457—466).—Pedler lecture. The theoretical basis of stereochemistry is developed from the viewpoint of the wave theory of the electron, using the method of localised pairs. The modes of vibration of a tridimensional system of an electron moving in the field of the nucleus are considered, the positions of nodal surfaces being inferred. The reasoning gives provisional explanations of the non-planar configuration of the NH_3 mol. and the angular configuration of the H_2O mol. In the case of C it is necessary to introduce the conception of hybrid orbitals, the theory leading to the tetrahedral arrangement of bonds in the C atom, planar configuration of B valencies, and linear arrangement of bi-covalent Be. The arrangements of bonds in 4-covalent Ni, Pd, and Pt, and 6-covalent Co are also explained. A. J. M.

Units and dimensions. E. A. Guggenheim (*Phil. Mag.*, 1942, [vii], **33**, 479—496).—A self-consistent notation for all physical quantities is described. L. J. J.

Theory of scratching. E. Madelung (*Naturwiss.*, 1942, **30**, 223—224).—It is calc. that a temp. of 600° may be reached in a breadth of 0·02 mm. when a needle loaded with 400 g. travels over glass with a velocity >20 cm. per sec. O. D. S.

Scratching process and molecular strength. A. Smekal (*Naturwiss.*, 1942, **30**, 224—225).—Calculation of the energy per g. of glass displaced in scratching with small loads shows that the mol. strength of glass is effective in the scratching process. O. D. S.

Paradox in the theory of heat conduction. G. Jaffé (*Physical Rev.*, 1942, [ii], **61**, 643—647).—Mathematical. N. M. B.

Energy levels and thermodynamic functions for molecules with internal rotation. I. Rigid frame with attached tops. K. S. Pitzer and W. D. Gwinn (*J. Chem. Physics*, 1942, **10**, 428—440).—F/T, S, and $(H_T - H_0)/T$ are tabulated for mols. with one internal rotation and potential energy $(V/2)(1 - \cos n\phi)$. A general treatment is given for mols. having overall moments of inertia independent of internal rotation. L. J. J.

Application of tensor analysis to molecular anisotropy. E. V. Chalam (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 190—194).—A general expression for the anisotropy of a mol. is derived in terms of the anisotropies of its individual bonds. W. R. A.

Interaction between loosely bound valency electrons and the splitting (double binding) rule. O. Schmidt (*Physikal. Z.*, 1942, **43**, 73—91).—The rule previously put forward (A., 1942, I, 163, 197) for graphite and aromatic compounds is extended to unsaturated org. compounds, all of which contain loosely-bound valency (or B-) electrons which are regarded as "free." The interaction of these electrons is considered according to the theory of Wigner and Seitz; the present rule gives the interaction between B- and A-electrons, and makes it possible to calculate binding energies. The rule holds for org. substances with distorted fields due to uncoupled B-electrons, and throws light on unsaturation, non-directed and directed and non-localised valencies, and on the homopolar linkage and its connexion with the metallic link. Both A- and B-electrons can take part in a linkage. There is a series of wave-functions of A- and B-electrons which belong to the same energy val. The nature of the metallic binding is discussed. The criterion of a metal is that it consists of atoms all of which are equiv. The units of a non-conductor are mols. The wave-functions of conductivity electrons, which form plane waves, are also characteristic of metals. A. J. M.

[Method for calculating] the carbon valency angle. G. W. Thiessen (*J. Chem. Educ.*, 1942, **19**, 198; cf. A., 1942, I, 196). L. S. T.

Valency and orientation. G. N. Copley (*Nature*, 1942, **149**, 730—731).—The following rule is given: if X be the atom attached to the C_6H_6 nucleus in a compound C_6H_5Y, then the group Y which contains X is an *o-/p*-directing group when the valency of X is >4, and a *m*-directing group when it is <4. Ambiguity at X^{IV} is considered. A. A. E.

Modern valency formulæ and the elementary student. G. N. Copley (*Chem. and Ind.*, 1942, 344—346).—An amplification of views already expressed (A., 1942, I, 196). A. J. M.

Valency and central forces in bent symmetrical XY_2 molecules. W. H. Shaffer and R. R. Newton (*J. Chem. Physics*, 1942, **10**, 405—409).—Force consts. in the quadratic and cubic parts of the potential function of the H_2O mol. are evaluated for valency and central forces. L. J. J.

Electronic structure and stability of hydrogen halides and of complex ions XO_6. K. Fajans and N. Bauer (*J. Chem. Physics*, 1942, **10**, 410—415).—In spherically symmetrical H halide mols. (internuclear distance r_0) the amount of negative charge beyond the sphere of radius r_0 is $1e$. The amount of negative charge shifted to the proton in the formation of a H halide mol. from a free halide ion increases with the electronic polarisability of the anion. In SiO_4^{4-}, PO_4^{3-}, SO_4^{2-}, and ClO_4^- the X–O binding shows a gradual change towards the unpolar type as the O octet is progressively tightened by the increasing electrostatic field of the Si^{4+}, P^{5+}, etc. cation. Refraction, dispersion, and size of the O octet diminish in the given order. The instability of the structure increases with deformation of electronic shells by electrostatic polarisation. L. J. J.

Model for the "hydrogen bond." The chain association of hydrogen fluoride. G. Briegleb (*Z. physikal. Chem.*, 1941, **51, B**, 9—38).—Fredenhagen's vals. (A., 1934, 731) for the v.d. of HF are interpreted on the assumption that an equilibrium $HF + (HF)_n \rightleftharpoons (HF)_{n+1}$ exists, giving a statistical distribution between mols. of all sizes. The equilibrium consts. and heats of reaction at 301° and 311° K. are tabulated for $n = 1$ to $n = 11$, and curves show the distribution between mols. with $n = 1$ to $n = 8$ from 100 to 700 mm. pressure. A theory of the H bond is developed with special reference to the $(HF)_n$ chain. The valency force is made up of the dipole attraction between the F^-–H^+ dipoles, and a factor due to the change in the F–H linkage on association. A min. of potential energy exists for an antiparallel orientation of the mols. The model gives vals. agreeing with experiment for the F–F distance, the chain angle, and for the heats of reaction for $n\text{HF} \rightarrow (\text{HF})_n$. O. D. S.

Magnetism and molecular structure. P. W. Selwood (*J. Chem. Educ.*, 1942, **19**, 181—188). L. S. T.

Construction of complex molecular models with application to carbohydrates. R. S. Bear (*J. Chem. Educ.*, 1942, **19**, 227—230). L. S. T.

Statistical mechanics of nearest neighbour systems. II. General theory and application to two-dimensional ferromagnets. E. W. Montroll (*J. Chem. Physics*, 1942, **10**, 61—77; cf. A., 1942, I, 10).—Mathematical. W. R. A.

Partition function of molecules with internal torsion. I. Single asymmetric top attached to rigid framework. (Miss) D. Price (*J. Chem. Physics*, 1942, **10**, 80).—Erratum (cf. A., 1942, I, 84). W. R. A.

Quantum-theoretical calculations on the quinonoid state. F. Seel (*Z. physikal. Chem.*, 1942, **B, 51**, 229—243).—Mathematical. W. R. A.

Radial distribution function in liquids. J. G. Kirkwood and (Miss) E. M. Boggs (*J. Chem. Physics*, 1942, **10**, 394—402).—Mathematical. An integral equation for the radial distribution function for pairs in a liquid has been developed and vals. for A at 90° K. are compared with those derived from X-ray scattering data. W. R. A.

Definition of Loschmidt's number. R. W. Pohl (*Physical. Z.*, 1942, **43**, 125—128).—Three definitions of Loschmidt's no. are considered. That based on $N_L = 6{\cdot}02 \times 10^{23}$/mol. wt. is satisfactory, but the val. obtained from $N_L = 1/m$ (m = mass. of mol.) involves a unit, and is wrong dimensionally. That based on the gas law is also open to objection. A. J. M.

III.—CRYSTAL STRUCTURE.

Application of X-rays in science and industry. R. Brill (*Angew. Chem.*, 1942, **55**, 69—76).—A lecture.

Integral breadths of Debye-Scherrer lines. A. R. Stokes and A. J. C. Wilson (*Proc. Camb. Phil. Soc.*, 1942, **38**, 313—322).—The reciprocal of the integral breadth of any reflexion from a crystal of the cubic system is shown to be $\cos \theta/\lambda \times$ vol. average of the thickness of the crystal perpendicular to the reflecting plane. Agreement with Patterson's result is obtained for a spherical crystal. L. J. J.

Raman's theory of specific heat of crystals. M. Blackman and M. Born (*Nature*, 1942, **150**, 55).—Raman's views (A., 1942, I, 226) are rejected and the lattice theory is supported. A. A. E.

New synthesis of X-ray data for crystal analysis. S. H. Yü (*Nature*, 1942, **149**, 638—639).—Mathematical, leading to the construction of a point diagram similar to the Patterson vector diagram but affording more useful information. A. A. E.

New synthesis of X-ray data for crystal analysis. H. Lipson (*Nature*, 1942, **150**, 25; cf. preceding abstract).—A criticism. A. A. E.

Elementary derivation of the 230 space-groups. J. D. H. Donnay (*Amer. Min.*, 1940, **25**, 206). L. S. T.

X-Ray study of carbon black. J. Biscoe and B. E. Warren (*J. Appl. Physics*, 1942, **13**, 364—371).—X-Ray investigation of a no. of C blacks, prepared in different ways, shows that the structure consists of true graphite layers arranged roughly parallel and equidistant, but otherwise completely random. In any individual layer the dimensions are the same as in graphite, but the layer separation is > than in graphite. Heat-treatment causes increase in size of the parallel layer groups. C black is neither cryst. nor

amorphous, and the term "turbostratic" (unordered layers) is suggested for this class of mesomorphic solids. Small-angle scattering investigations indicate the presence of clusters a few hundred A. in size, and it is these that are determined by microscope counts and by the electron microscope. A. J. M.

Crystal dynamics of rock-salt. K. Lonsdale (*Nature*, 1942, **149**, 698—699).—Venkateswaran's observations (A., 1942, I, 86) are challenged as regards both accuracy and interpretation. They do not contradict the Faxén–Waller thermal theory and the Born lattice theory. A. A. E.

Isotypism of $YPO_4,2H_2O$ and $CaSO_4,2H_2O$. H. Strunz (*Naturwiss.*, 1942, **30**, 64).—*X*-Ray investigation of weinschenkite $(Y,Er)PO_4,2H_2O$ and gypsum shows that they have the same type of structure and formula. A. J. M.

Conversion of cellulose hydrate into natural cellulose. VII. Crystal structure of the transition product and an extremely highly oriented natural cellulose preparation. T. Kubo (*Z. physikal. Chem.*, 1940, **A**, **187**, 297—312).—The crystal structures of two materials have been investigated. Both have a monoclinic lattice with *a* 8·23 and 8·05, *b* 10·3 and 10·3, *c* 7·92 and 7·98 A. and β 88·5° and 89·0° for the transition product and for highly oriented cellulose (ramie), respectively. The results are compared with those for other cellulose products. J. W. S.

Crystal structure of hydrazinium difluoride. M. L. Kronberg and D. Harker (*J. Chem. Physics*, 1942, **10**, 309—317).—From *X*-ray analysis $N_2H_6F_2$ has a rhomohedral unit cell with a_0 5·43 A., α 38° 10′, one mol. per unit cell. The determined positions of the atoms indicate *trans*-hydrazinium ions with linear H-bonds to F′ ions at the corners of an elongated octahedron. Each F′ ion forms three H-bonds with different N_2H_6" ions and condenses the octahedra into continuous layers. Consequently the packing of these layers brings each N into contact with an "extra" F′ ion and gives N co-ordination no. 5. The N—N and N—H---F distances are 1·42 and 2·62 A. and the at. charges are discussed. W. R. A.

Crystal structure of *trans-trans*-methyl fumarate and *trans-trans*-methyl muconate. (Miss) I. E. Knaggs and (Mrs.) K. Lonsdale (*J.C.S.*, 1942, 417—418).—These esters crystallise in the triclinic system, with 1 mol. per unit cell. *trans-trans*-Me fumarate (**I**) has *a* 3·92, *b* 9·24, *c* 5·93 A.; α 101° 47′, β 112° 49′, γ 109° 20′. *trans-trans*-Me muconate (**II**) has *a* 5·83, *b* 11·71, *c* 5·82 A.; α 100° 39′, β 87° 50′, γ 146° 2′. (**II**) is positively birefringent. The magnetic anisotropies of (**I**) and (**II**) have been determined, the vals. being typical of relatively long-chain conjugated mols. They do not agree with the vals. calc. from Pascal's consts., which cannot give accurate results for open conjugated chains unless the large diamagnetism normal to the chain is taken into account. A. J. M.

Can silicon take a six-fold co-ordination in glass? K. H. Sun and A. Silverman (*J. Amer. Ceram. Soc.*, 1942, **25**, 101—103).—It is suggested that the experimentally determined co-ordination nos. for vitreous SiO_2 and certain Na_2O–CaO–SiO_2 glasses, which vary from 4·3 to 4·8, deviate from the theoretical val. of 4 owing to the partial formation of a 6-fold co-ordination. The theory is supported by an examination of the at. sizes, valency rules, and the compositions of certain glasses (PbO 91·8, SiO_2 8·2; PbO 90·04, Na_2O 1·83, SiO_2 7·99; Fe_2O_3 40·00, Na_2O 27·43, SiO_2 32·57%) which show O/Si ratios of 5·01, 5·831, and 4·23, respectively. It is believed that a glass composed entirely of SiO_6 groups cannot exist. J. A. S.

Secondary scattering of electrons in silicon. R. P. Johnson and W. R. Grams (*Physical Rev.*, 1942, [ii], **61**, 671—672).—Germer's observation and explanation (cf. A., 1942, I, 260) of the anomalously high intensity of the (222) ring in electron diffraction patterns of polycryst. CuCl are supported by similar observations for polycryst. Si, where the ring is prominent but should be entirely absent. N. M. B.

Ultimate resolving power of the electron microscope. L. I. Schiff (*Physical Rev.*, 1942, [ii], **61**, 721—722).—The theoretical possibility of obtaining images of the arrangement of atoms within a mol. is examined with reference to limitations on resolution due to diffraction and contrast. N. M. B.

Crystalline reflexions in electron microscope images. J. Hillier and R. F. Baker (*Physical Rev.*, 1942, [ii], **61**, 722—723).—Electron micrographs of Al_2O_3,H_2O confirm that the image density depends on the orientation of the crystals relative to the direction of the illuminating electron beam. Results show that the phenomenon is due to Bragg reflexions from those cryst. planes which are properly oriented. N. M. B.

Field emission from tungsten and thoriated tungsten single crystals. J. H. Daniel (*Physical Rev.*, 1942, [ii], **61**, 657—667).—A reproducible time sequence of different pattern types appears in electron projector images of field emission from W single crystals above 1100° K. This can best be explained as the result of rearrangement of adsorbed gas atoms on certain crystallographic surface areas under the influence of temp. and field. The relative variation of emission intensity with crystallographic direction in thermionic and in field emission is discussed. Types of field emission patterns obtained from Th-incorporated W wire differed from those from points of pure W on which Th was evaporated, but they merged after outgassing. N. M. B.

Potassium tetrathionate as an example of monoclinic hemihedral symmetry. G. Tunell, H. E. Merwin, and C. J. Ksanda (*Amer. Min.*, 1939, **24**, 193).—$K_2S_4O_6$ shows pronounced monoclinic hemihedrism, and a marked pyroelectric effect. L. S. T.

Structure of metal crystals. L. Graf (*Z. Elektrochem.*, 1942, **48**, 181—210).—The crystal structure of metals and alloys and the mechanism of crystal growth are discussed and illustrated by numerous micrographs. C. R. H.

Stress–strain curve for atomic lattice of aluminium. W. A. Wood and S. L. Smith (*J. Inst. Metals*, 1941, **67**, 315—324).—A curve giving the displacement of Al atoms from their normal positions on a selected set of at. planes on the application of tensile stress, and their recovery on removal of the stress, is constructed from *X*-ray measurements of the lattice paremeter during the test. The places chosen are those with spacing perpendicular to the applied stress, which should contract in conformity with the external dimensions as the specimen stretches. The contraction in lattice spacing is a linear function of the applied stress up to the yield point, beyond which it slows down, rapidly reaching a limiting val., and then, as the load approaches the ultimate strength of the metal, is replaced by a small expansion. When the metal is subjected to cycles of stress > the yield point the contracted lattice expands back to a val. > its original val. as the stress is removed. This permanent lattice expansion increases regularly with increasing applied stress, thus explaining the shape of the lattice stress–strain curve. An expanded lattice is restored to normal only by annealing at > 150°. A. R. P.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Electrical properties of solids. R. M. Fuoss (*J. Chem. Educ.*, 1942, **19**, 190—193, 231—235). L. S. T.

Intermolecular forces and the diamagnetism of organic molecules. F. von Rautenfeld and E. Steurer (*Z. physikal. Chem.*, 1941, **B**, **51**, 39—48).—Measured vals. for the diamagnetic susceptibility of mixtures of pairs of org. compounds showed deviations from an additive law for compounds possessing strong intermol. forces, *e.g.*, alcohols, acids, and ketones. The additive law is obeyed for ethers and hydrocarbons. Deviations from the additive law are due to the influence of the changes in the electronic structure caused by intermol. forces on the diamagnetism of the mols. O. D. S.

Superconducting compounds with very high transition temperatures (NbH and NbN). G. Aschermann, E. Friederich, E. Justi, and J. Kramer (*Physikal. Z.*, 1941, **42**, 349—360).—Suitably prepared specimens of NbH and NbN become superconducting at ~15° and ~23° K., respectively, and thus have the highest transition temp. (T^*) of known superconductors. The prep. of the specimens is described and a detailed chemical and *X*-ray examination, rendered necessary by the large effects of impurities and thermal treatment, is reported. Since the r_T–f(T) curves show considerable hysteresis and the superconductivity is reduced by purification, conductivity is probably of a lattice defect type. With NbN the negative Hall const. increases rapidly as T falls, although r_T decreases slowly. Unusual hysteresis effects in applied magnetic fields are described. Persistent current experiments show NbN to be a true superconductor; the magnetic threshold is high and NbN is magnetically "soft." Superconducting centres appear to persist above T^* in NbN when a superconducting specimen is warmed. Nb_2N, NbO, Nb_2O_3, Nb_2O_5, NbB, TaN, Ta_2N, and TaH are not superconducting at >9·5° K.; *X*-ray data for these compounds are briefly discussed. A. J. E. W.

Emission of sound in the transition from normal to superconduction in a magnetic field. E. Justi (*Physikal. Z.*, 1942, **43**, 130—133).—In the transition normal ⇌ superconduction of NbN and Nb in a magnetic field, an effect similar to the Barkhausen effect in ferromagnetics is observed. The transition therefore occurs over microranges and not in one step. A. J. M.

Influence of ultrasonic waves on the magnetic behaviour of nickel. II. Measurements with a magnetometer and with a magnetic section of nickel tube. G. Schmid and U. Jetter (*Z. Elektrochem.*, 1942, **48**, 227—240).—The qual. effects previously reported (cf. *ibid.*, 1941, **47**, 155) have been quantitatively investigated with confirmatory results. C. R. H.

Optical properties of organic and inorganic compounds compared. A. N. Winchell (*Amer. Min.*, 1939, **24**, 194).—A diagram showing the optical properties of ~1000 org. compounds has been prepared for purposes of identification. Org. compounds show larger variations than the inorg. L. S. T.

Dynamical treatment of the elements of heat. G. B. Brown (*Phil. Mag.*, 1942, [vii], **33**, 543—551).—The dynamical treatment described

leads to a dynamical temp. scale equiv. to the Kelvin abs. scale, without recourse to reversible cycles. L. J. J.

Heat capacity of certain halogenomethanes. G. Glockler and W. F. Edgell (*Ind. Eng. Chem.*, 1942, **34**, 532—534; cf. A., 1941, I, 405). J. W. S.

Experimental melting of graphite in argon under a pressure of 11,500 kg. per sq. cm. Determination of the triple point and construction of a tentative diagram of the solid, liquid, and gaseous phases of carbon. J. Basset (*Brennstoff-Chem.*, 1942, **23**, 127—135).—A graphite bar 15 mm. long and 2 mm. in diameter was mounted between two poles in a high-pressure A chamber and a current of increasing intensity was passed until the graphite evaporated or melted. The co-ordinates of the triple point of C are ~100 kg. per sq. cm. and 4000° K.; below this pressure C sublimes without melting but above it is stable in all the phases. Above the triple point the melting temp. rises slowly with the pressure. Graphite particles melted at 4000 kg. per sq. cm. had d 2·25. The molten graphite cryst. on cooling in the form of graphite at pressures up to 1500 kg. per sq. cm. A tentative complete diagram for all three phases of C has been constructed. R. B. C.

M.p. of neodymium and praseodymium fluorides. H. von Wartenberg (*Naturwiss.*, 1941, **29**, 771).—M.p. are NdF_3 1410°, PrF_3 1370°. A. J. M.

Energy states of solids. Evidence from thermal data for the existence of low electronic energy levels in europium ion. Heat capacity of europium sulphate octahydrate from 60° to 300° K. E. A. Long and R. A. Degraff (*J. Amer. Chem. Soc.*, 1942, **64**, 1346—1349).—Vals. of C_p for $Eu_2(SO_4)_3,8H_2O$ have been measured calorimetrically from 60° to 300° K., and from them and the corresponding vals. for $Gd_2(SO_4)_3,8H_2O$ the C_v of the $Eu^{...}$ ion have been derived. A comparison of these experimental C_v with vals. calc. from the energy levels from absorption spectra studies by Spedding *et al.* (A., 1941, I, 71) indicates that the cryst. field about the $Eu^{...}$ ion in this salt is probably not one of pure cubic symmetry, but that a small rhombic contribution must be considered. The energy levels observed by Spedding *et al.* at 383 and 435 cm.$^{-1}$ above the ground state are probably electronic and not vibrational. W. R. A.

Thermal properties of fluorochloro-derivatives of methane. G. Seger (*Angew. Chem.*, 1942, **55**, 58—59).—The b.p., v.p., heat of vaporisation, and crit. data are given for 15 derivatives of CH_4, suitable for use as refrigerants. D. F. R.

Hysteresis phenomena. A. Smits (*Z. physikal. Chem.*, 1941, **B**, **51**, 1—8).—The hysteresis effect in the vol.-temp. curves of NH_4Br and ND_4Br in the neighbourhood of the transition points at −58·4° and at ~−58° and −110° respectively is discussed. O. D. S.

Vapour pressure of bromoform. V. A. Kireev and I. P. Sitnikov (*J. Appl. Chem. Russ.*, 1941, **14**, 483—485).—Measurements between 20° and 100° can be represented by $\log p = -2231{\cdot}3/T + 8{\cdot}23438$, where p is in mm. Hg. J. J. B.

Lattice spacing and thermal expansion of copper. W. Hume-Rothery and K. W. Andrews (*J. Inst. Metals*, 1942, **68**, 19—26).—The lattice parameters of five different samples of Cu at 18° showed only very small differences, which could be accounted for by the impurities present; the most probable val. for pure Cu is 3·6074 A. The lattice expansion of 99·998% Cu agrees with the expansion of massive Cu up to 500° but is smaller above this temp. probably owing to the presence of gas in the massive metal. A. R. P.

Thermal expansion of single and optically mosaic zinc crystals. W. P. Staker (*Physical Rev.*, 1942, [ii], **61**, 653—657).—Measurements in the temp. range 25—100° by an optical-lever method are reported for 16 single crystals. The dependence on orientation follows the $\cos^2$ symmetry relation. The principal coeffs., parallel and perpendicular to the hexagonal axis are $64{\cdot}2 \times 10^{-6}$ and $14{\cdot}1 \times 10^{-6}$ per degree, respectively. Optically mosaic crystals gave similar vals. Permanent strain lowered the coeffs. slightly. N. M. B.

Precise determination of lattice constants and coefficients of expansion of rhombic crystals of lead chloride. M. Straumanis and J. Sauka (*Z. physikal. Chem.*, 1942, **B**, **51**, 219—228).—Lattice consts. and coeffs. of expansion of $PbCl_2$ in the direction of the a, b, and c axes have been measured. W. R. A.

Thermodynamic properties of light hydrocarbons. D. E. Holcomb and G. G. Brown (*Ind. Eng. Chem.*, 1942, **34**, 590—602).—The thermal properties of n-hydrocarbons from CH_4 to C_8H_{18} over wide temp. and pressure ranges are given in graphs, the liquid at 0° and zero pressure being taken as the reference state. The application of the data to high-pressure absorber and fractionator operation is indicated. J. W. S.

Generalised thermodynamic properties of gases at high pressures. S. H. Maron and D. Turnbull (*Ind. Eng. Chem.*, 1942, **34**, 544—551).—Methods of deducing the thermodynamic properties of gases at high pressures are classified and discussed. A new empirical equation of state of the form $PV = RT + a_1P + a_2P^2 + a_3P^3 + a_4P^4$, where a_1, a_2, a_3, and a_4 are virial coeffs. dependent on temp. only, is presented. The equation permits the calculation of the compressibilities of gases at ≯1000 atm. and over a wide temp. range from the crit. temp. and pressure with a max. deviation of <3%. The generalised activity coeffs. deduced from the equation are in accord with Newton's plots (A., 1935, 575) for the same temp. and pressure interval. The applications of the equation to the calculation of ΔS, ΔH, Joule–Thomson coeff., and ΔC_p are also discussed. J. W. S.

Determination of Lennard-Jones parameters from second virial coefficients. Tabulation of second virial coefficient. W. H. Stockmayer and J. A. Beattie (*J. Chem. Physics*, 1942, **10**, 476—477).—Vals. from the crit. to the Boyle temp. for all gases are tabulated. L. J. J.

Prediction of critical constants. H. P. Meissner and E. M. Redding (*Ind. Eng. Chem.*, 1942, **34**, 521—526).—Relations permitting the calculation of the crit. vol. from the parachor, the crit. temp. from the b.p. and factors dependent on the mol. structure, and the crit. pressure from the crit. temp. and crit. vol. are suggested. For compounds which are not highly associated the formulæ yield results in fairly good accord with observation. J. W. S.

Viscosity of liquids in homologous series. R. Linke (*Z. physikal. Chem.*, 1940, **A**, **187**, 227—234).—The consts. A and B in the equation $\log \eta = A + B/4{\cdot}57T$ are calc. for a no. of homologous series. A and B vary linearly with the no. of C atoms. O. D. S.

Frictional phenomena. X. Lubrication. A. Gemant (*J. Appl. Physics*, 1942, **13**, 355—360).—The mechanism of film lubrication in which the film thickness is $>10^{-5}$ cm. is chiefly controlled by the η of the lubricant. The mathematical theory is developed. Boundary lubrication, occurring with films $<10^{-5}$ cm. thick, is due to plastic flow within the boundary layer. A. J. M.

Structure mechanics of viscous-elastic continua. V. Viscosity and mol. wt.—See A., 1942, I, 293.

Determination of viscosity with the turboviscosimeter.—See B., 1942, I, 323.

Self-diffusion of zinc. P. H. Miller, jun., and F. R. Banks (*Physical Rev.*, 1942, [ii], **61**, 648—652; cf. A., 1941, I, 201).—Measurements, in the temp. range 340—410°, by means of a sectioning method with long-lived ^{65}Zn as indicator, are reported for 18 single crystals of various orientations and for polycryst. Zn. N. M. B.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Second virial coefficient for gas mixtures. J. A. Beattie and W. H. Stockmayer (*J. Chem. Physics*, 1942, **10**, 473—476).—Vals. for CH_4, n-C_4H_{10}, and their mixtures are calc., and the interaction term for CH_4–n-C_4H_{10} is calc. from 150° to 300°. L. J. J.

Kinetic theory of gases and viscosity of binary gas mixtures. W. Schudel (*Monats. Bull. Schweiz. Ver. Gas- u. Wasserfachm.*, 1942, **22**, 21—30; *Chem. Zentr.*, 1942, I, 2627).—With reference to the equation for the determining the η of a gas mixture, viz., $\eta_m = \eta_1/(1 + AV_2/V_1) + \eta_2/(1 + BV_1/V_2)$ (where V_1 and V_2 are the vols. of the two gases and η_1, η_2, and η_m the viscosities of the two gases and of the mixture respectively), the relation $A/B = \eta_1S_2/\eta_2S_1$ between A and B is given (S = sp. gr.), from which it is possible to assess the friction in the mixture when only one point in the mixture curve is available. R. B. C.

Discontinuities in properties of liquid systems. G. Antonoff, M. Chanin, and M. Hecht (*J. Physical Chem.*, 1942, **46**, 486—491).—Increase of d, n, and η with increase in concn. of solutions of $Pr^{\beta}CO_2H$ is discontinuous. Similar discontinuities are observed in the d curve of aq. PhOH. C. R. H.

Dielectric loss in paraffin wax solutions. H. Fröhlich (*Proc. Physical Soc.*, 1942, **54**, 422—428).—Mathematical. The dielectric loss of a dil. solution of long-chain mols. containing dipoles in solid paraffin is investigated. The structure of the substances, accounting for the time of relaxation τ, is examined, and the evaluation of τ is deduced. N. M. B.

Diffusion coefficients of chromate and polychromate ions. G. Jander and H. Spandau (*Z. anorg. Chem.*, 1942, **249**, 65—75).—Vals. of D for the CrO_4'', Cr_2O_7'', and Cr_3O_{10}'' ions are recorded. The CrO_4'' ion has ≮7 mols. of H_2O of hydration. F. J. G.

Diffusion of soaps in a saline medium. O. Lamm (*Kolloid-Z.*, 1942, **98**, 45—52).—A new diffusion vessel is described. Measurements of the diffusion coeff. are recorded for K octoate (**I**), decoate (**II**), and dodecoate (**III**) in N-KCl. The results indicate that micelles are fully developed at a concn. of 0·3N. for (**I**), 0·03N. for (**II**), and 0·005N. for (**III**). F. L. U.

Thermal analysis in the microscope with heated stage. A. Kofler (*Z. physikal. Chem.*, 1940, **A**, **187**, 201—210).—By the use of a microscope with heated object stage the eutectic diagrams of binary mixtures can be rapidly determined on micro-samples. The process of melting is observed visually and the eutectic temp. and crystallis-

ation temp. noted. Curves for $C_{10}H_8$–p-$C_6H_4Me{\cdot}NO_2$ and $C_{10}H_8$–1 : 2 : 4-$C_6H_3Me(NO_2)_2$ agree with previous vals. O. D. S.

Structure and constitution of glass.—See B., 1942, I, 382.

Order in the alloy Cu_3Au. L. H. Germer, F. E. Haworth, and J. J. Lander (*Physical Rev.*, 1942, [ii], **61**, 614—626).—A detailed account of work previously reported (cf. A., 1941, I, 169). N. M. B.

Equilibrium diagram of system silver–gallium. I. α-Phase region. W. Hume-Rothery and K. W. Andrews (*J. Inst. Metals*, 1942, **68**, 133—143).—An accurate re-determination of the liquidus in the α-phase region does not confirm the hypothesis of whole-no. liquidus factors, which is, therefore, now discarded. The peritectic horizontal α + liquid $\rightleftharpoons \zeta$ is at 610·6° and starts at 28·3 at.-% Ga. The solidus curve shows a slight inflexion and terminates on the peritectic horizontal at ~19 at.-% Ga; below this temp. the solid solubility of Ga in Ag decreases slowly to ~18 at.-% Ga at 378°, at which temp. the close-packed hexagonal ζ-phase decomposes into $\alpha + \zeta'$ eutectoid, and then falls linearly to ~12 at.-% Ga at 200°. The point giving the composition of ζ divides the peritectic line at 610·6° in an exact 2 : 1 ratio. A. R. P.

Ferromagnetic gold–iron alloys. S. T. Pan, A. R. Kaufmann, and F. Bitter (*J. Chem. Physics*, 1942, **10**, 318—321).—Magnetic measurements were made on a Au–Fe alloy containing 37% Fe, in both the quenched and successively annealed states. The quenched supersaturated solid solution is ferromagnetic, and when it is slowly heated perceptible pptn. takes place at ~450°. Both the final Au-rich and Fe-rich phases pptd. at 450° are magnetic at room temp. The magnetic measurements, checked by Debye–Scherrer patterns, show that the mechanism of pptn. in this alloy is chiefly of the non-uniform type. W. R. A.

Relation between atomic arrangement and coercivity in an alloy of iron and platinum. H. Lipson, D. Shoenberg, and G. V. Stupart (*J. Inst. Metals*, 1941, **67**, 333—340).—The alloy FePt after homogenising has a face-centred tetragonal lattice of the CuAu type, a 2·714, c 3·715 A., $d_{calc.}$ 15·15, $d_{obs.}$ 14·91; the Fe atoms are at the corners and the Pt atoms at centres of the unit cell. At very high temp. (~1500°) the lattice appears to become face-centred cubic with random orientation of the atoms; this state cannot be retained by quenching but the quenched alloy has a coercivity of ~1200 gauss compared with ~150 gauss for the annealed alloy and its microstructure shows the crystal grains crossed by parallel bands ascribed to twinning bands due to breakdown of the high-temp. cubic form. It is suggested that the high coercivity is due to the high strains set up by the atoms in the tetragonal lattice attempting to approximate to their original cubic form. A. R. P.

Constitution of the aluminium-rich alloys of the aluminium–nickel–iron and aluminium–nickel–silicon systems. H. W. L. Phillips (*J. Inst. Metals*, 1942, **68**, 27—46).—These ternary systems were examined by thermal and micrographic methods up to Ni 3, Fe 3% and Ni 5, Si 12% respectively under conditions of metastable equilibrium such as occur in industrial practice. The $NiAl_3$–Al eutectic is placed at 640°, 6·36% Ni, the solubility of $NiAl_3$ in Al at <0·05%, and the ternary Al–Si–$NiAl_3$ eutectic at 567°, Ni 4·9, Si 10·98%; no ternary compound exists in this region. Fe, Ni, and Al form a ternary compound (**I**) which forms a ternary eutectic with Al and $NiAl_3$ at 638°, Ni 6·27, Fe 0·28%; at 3% Ni the primary (**I**) field starts at 0·9% Fe and alloys containing (**I**) tend to be weak since (**I**) separates in large, brittle crystals. With Fe-rich alloys (**I**) is formed by a peritectic reaction between $FeAl_3$ and liquid, the $FeAl_3$ crystals becoming rapidly coated with (**I**) so that equilibrium is difficult of attainment. At 649°, Fe 1·8, Ni 1·2% there is an invariant point at which $FeAl_3$, (**I**), and Al are in equilibrium with the liquid. Ternary diagrams and sections at const. Fe and Ni contents are reproduced. A. R. P.

***X*-Ray study of new α′-phase in the magnetic iron–nickel–aluminium ternary alloy system.** S. Kiuti (*Japan Nickel Rev.*, 1941, **9**, 78—104).—Micrographic examination and *X*-ray analysis of magnetic alloys in the Fe corner of the Fe–Ni–Al system show that the high coercivity obtained by appropriate heat-treatment is due not to pptn. of γ but to decomp. of the face-centred Fe-rich α-phase with the separation of α′ which is essentially a solid solution of Ni and Fe in NiAl. A. R. P.

Nomograph for the solubility of chlorine monoxide in water. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 624).—A nomograph indicating the solubility of Cl_2O in H_2O at 0—20° and 1—70 mm. has been constructed from the data of Secoy and Cady (A., 1942, I, 19). J. W. S.

Effect of salts on the mutual miscibility of *n*-butyl alcohol and water. L. A. Reber, W. M. McNabb, and W. W. Lucasse (*J. Physical Chem.*, 1942, **46**, 500—515).—At the crit. solution temp. (θ = 124·40°) the system Bu^nOH–H_2O contains 68·1% of H_2O. Na_2SO_4, NaCl, NaBr, $NaNO_3$, and NaI raise θ and shift the max. of the temp.–concn. curves toward lower [H_2O] whilst NaCNS lowers θ and shifts the max. in the opposite direction. C. H. R.

Solvent power of hydrochloric acid for chlorides. W. Fischer (*Z. anorg. Chem.*, 1941, **247**, 384—391; cf. preceding abstract).—A survey of data for the change of solubility (S) of chlorides of Li, Na, K, Be, Mg, Ca, Al, Co, Ni, and Cu in aq. HCl with [HCl] shows that generally the effect of HCl is to enhance the differences between chemically similar elements; this effect is still further increased in presence of Et_2O. Min. in the S–[HCl] curves are shown by KCl, $CoCl_2$, and $CuCl_2$. The influence of HCl on S is discussed theoretically. F. L. U.

Solubility of calcium phosphate. I. Effect of p_H and of amount of solid phase. II. Solubility product. I. Greenwald (*J. Biol. Chem.*, 1942, **143**, 703—710, 711—714).—I. The work of Logan and Taylor (A., 1937, I, 412) is criticised. The solubility product, $[Ca^{\cdot\cdot}]^3[HPO_4''']^2/[H^{\cdot}]^2$, is not const., but increases with increasing amount of solid phase and with increasing p_H.

II. Reasons are given for using the expression $[Ca^{\cdot\cdot}]^3[HPO_4''']^2/[H^{\cdot}]^2$ instead of $[Ca^{\cdot\cdot}]^3[PO_4''']^2$ as the solubility product of $Ca_3(PO_4)_2$. F. J. G.

Solubility of lead sulphate and of lead oxalate in various media. I. M. Kolthoff, R. W. Perlich, and D. Weiblen (*J. Physical Chem.*, 1942, **46**, 561—570).—The solubility (S) of $PbSO_4$ in aq. Na_2SO_4 sinks rapidly with increasing [Na_2SO_4] in the range 0—0·01M., reaches a min. near 0·05M., and then rises slowly up to 0·5M.; S is greatly increased in presence of $NaNO_3$, and decreased in 50% EtOH, in which a min. occurs near 0·05M-Na_2SO_4. Data for aq. H_2SO_4 (0—0·5M.) and aq. EtOH (0—70 vol.-%) show a flat min. at ~0·1M. for the former and a continuous decrease for the latter. PbC_2O_4 in aq. $K_2C_2O_4$ shows a min. S at 0·005M., and thereafter a linear increase with concn. up to 0·5M. The solubility product of PbC_2O_4 in H_2O at 26° is 5×10^{-10}, and the equilibrium const. $[Pb^{\cdot\cdot}][C_2O_4'']^2/[Pb(C_2O_4)_2''] = 2{\cdot}9 \times 10^{-7}$. S of PbC_2O_4 in aq. EtOH (0—30%) decreases continuously with increase in [EtOH]. For $PbCrO_4$ $S = 5 \times 10^{-7}$ g.-mol./l. The data for $PbSO_4$ refer to 25°, and all Pb determinations were made colorimetrically with diphenylthiocarbazone (dithizoné). F. L. U.

Equilibrium distribution of methyl alcohol between water vapour–air mixture and water. N. V. Tschalov and I. P. Tzvetaeva (*J. Appl. Chem. Russ.*, 1941, **14**, 794—799; cf. A., 1940, I, 73).—The equilibrium concn. of MeOH between the phases H_2O vapour–air and H_2O, determined over the range 5—50°, gave results slightly < those calc. from the theoretical formula deduced previously. Better agreement with the experimental data is given by the empirical formula $\log K = 1{\cdot}7595 - 0{\cdot}0256(\theta - 3)$, where $K = [MeOH]_{air}/[MeOH]_{water}$, and θ = temp. In terms of actual [MeOH], $Y = 0{\cdot}208e^{0{\cdot}340\theta \cdot 414}X$, where Y = [MeOH] in dry air in g. per cu. m. at n.t.p., X = wt.-% MeOH in H_2O, and θ = temp. N. G.

Carotenoids. III. Distribution of pure pigments between immiscible solvents.—See A., 1942, III, 787.

Adsorption of vapours by crystalline solid surfaces. D. M. Gans, U. S. Brooks, and G. E. Boyd (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 396—399).—Comparison of vals. of surface areas obtained from measurements of adsorption of H_2O, PrOH, and C_6H_6 vapours at 25°, and of N_2 at −195·5°, on TiO_2, SnO_2, ZnO, and quartz powder indicates that trustworthy vals. can be obtained from vapour adsorption data at room temp. L. S. T.

Laminar boundary layers in the transfer of matter between smooth plates and [a fluid] streaming parallel to them. G. Damköhler (*Z. Elektrochem.*, 1942, **48**, 178—181).—Mathematical. In the transfer of matter from plate to fluid the thickness of the boundary layer depends on both the rate of flow and the length of the plate measured along the direction of flow, whilst in transfer from fluid to plate it is independent of both factors. A practical corollary is that the rate of adsorption of a gas by a granular adsorbent cannot, whilst the rate of desorption can, be increased by increasing the rate of flow and by decreasing the grain size of the adsorbent. C. R. H.

Elimination of sorption–desorption hysteresis in hydrous oxide systems. I. Silica. H. B. Weiser, W. O. Milligan, and J. Holmes (*J. Physical Chem.*, 1942, **46**, 586—596).—With SiO_2 gel made by pptn. from water-glass a marked decrease in the separation of the curves of the hysteresis loop is caused by raising the temp. of pptn. A relatively small decrease in separation follows the same procedure if the gel is pptd. from freshly formed Na_2SiO_3 solution. The observed difference in behaviour is attributed to the presence in water-glass of much larger amounts of colloidal SiO_2. If Na_2SiO_3 solution is submitted to prolonged boiling, the H_2O sorption and desorption curves given by gels pptd. from it are coincident. The occurrence of a hysteresis loop therefore depends on some structure in the parent solution which is destroyed by ageing at the b.p. A brief review of theories proposed to account for the hysteresis loop is given. F. L. U.

Phenomena of adsorption on cellulose. (Mme.) J. G. Gavoret (*Ann. Chim.*, 1941, [xi], **15**, 97—186).—Theories of the structure of cellulose and of its swelling are summarised. The adsorption on cellulose from dil. aq. salt solutions of various concns. has been studied at room temp. and at various p_H vals. Heavy and hydrolysable cations tend to adsorb as hydroxides or to undergo exchange

with $H^{\cdot}$ ions of the cellulose, confirming its acidic nature. For adsorption of $Pb^{\cdot\cdot}$ there is a threshold at p_H 2·8 below which no adsorption occurs. Adsorption of heavy cations is accompanied by preferential adsorption of H_2O but does not cause simultaneous adsorption of anions. α-Cellulose has an adsorption threshold at p_H vals. > for cellulose and evidence is produced to indicate that the adsorptive capacity increases with depolymerisation and decreases with condensation. J. W. S.

Adsorption of dye by cellulose.—See B., 1942, II, 331.

Validity of Antonoff's rule. G. Antonoff (*J. Physical Chem.*, 1942, **46**, 497—499).—Discussion. C. R. H.

Structure of liquids in capillary layer. D. Rădulescu (*Kolloid-Z.*, 1942, **98**, 34—42).—Discussion of previous work, which is summarised (cf. A., 1937, I, 458; 1939, I, 415), leads to the conclusion that at the liquid–vapour interface the liquid mols. are packed much more closely than in the interior and possess lower kinetic energy; the heat of vaporisation of this layer has nearly twice the normal val. The transition from bulk liquid to capillary layer is fairly abrupt, and the thickness of the latter varies with the liquid, being ~10 mols. for CCl_4 and ~20 mols. for EtOAc. Mol. radii calc. from the discontinuities in adsorption or desorption isotherms are the same for different members of a homologous series, the mols. being arranged with their long axes parallel and normal to the surface. At the liquid–solid interface there is interposed between the capillary layer and the solid an adhesion layer 1 or 2 mols. thick, in which the mols. are still more tightly packed. Since many of the properties, including solvent power, of the modified liquid will differ from those of the bulk liquid, any solute present will not be uniformly distributed between contiguous layers, and its distribution should not be expressible by a simple formula with 1 or 2 consts. The application of the author's theory to adsorption in soils and to ionic exchange in permutit is discussed. F. L. U.

Surface fugacity and heat of free expansion on a surface for a single-component insoluble film. W. B. Innes and H. H. Rowley (*J. Physical Chem.*, 1942, **46**, 548—554).—These quantities are obtained as functions both of the spreading pressure F and of the fraction of the surface occupied, for systems in which the Langmuir adsorption equation is obeyed, and for those in which the behaviour can be represented by $F(A - B) = RT$, where A is the area and B is a const. related to the area occupied by the mols. themselves. Surface fugacity is ∝ the pressure of the three-dimensional gas or vapour in equilibrium with the surface; the proportionality const. is evaluated. F. L. U.

Superliquid in two dimensions and a first-order change in a condensed monolayer. II. Abnormal viscosity relations of alcohol monolayers in condensed liquid phases. L. E. Copeland, W. D. Harkins, and G. E. Boyd (*J. Chem. Physics*, 1942, **10**, 357—365; cf. A., 1938, **I**, 615).—In unimol. layers of alcohols the new LS phase (cf. A., 1942, I, 295) has the compressibility of a solid and, at temp. near the $L_2 \rightleftharpoons LS$ transition, low η vals. η varies abnormally with temp. The $S \rightleftharpoons LS$ transition occurs at ~19·98 sq. A. The effects of pressure, temp., and surface area on LS layers are discussed. W. R. A.

Energy relations of the surfaces of solids. II. Spreading pressures as related to the work of adhesion between a solid and a liquid. W. D. Harkins and H. K. Livingston (*J. Chem. Physics*, 1942, **10**, 342—356).—An extension of previous work (B., 1930, 1038; A., 1941, I, 411). The usual expression for the work of adhesion between a solid and a liquid ($W_{A(SL)}$) is incorrect. The correct equation is $W_{A(SL)} = f_{E(SV^s)} + \phi^S_{(LV^s)} + \gamma_L$, where the first term represents the free energy of emersion of the solid from the saturated vapour, the second the free energy of transfer of the solid from the liquid to the saturated vapour, and the third the surface tension of the liquid. The term "adhesion tension," which is always used incorrectly, should be discarded and the more suitable "spreading pressure" should be substituted. W. R. A.

The Teorell–Meyer–Sievers theory of membrane permeability. E. S. Fetcher, jun. (*J. Physical Chem.*, 1942, **46**, 570—571).—The theory (cf. A., 1936, 1065; 1937, III, 56) is critically discussed. F. L. U.

Chemistry of aluminium hydroxide suspensions. H. R. Kreider (*J. Amer. Med. Assoc.*, 1941, **117**, 1354—1356).—Suspensions of $Al(OH)_3$ react with HCl by chemical neutralisation rather than by adsorption. Below p_H 4 $Al(OH)_3$ reacts as an alkali and above p_H 9 it reacts as an acid. C. A. K.

Ageing and coprecipitation. XXXV. Ageing of lead chromate in the colloidal state. Thermal ageing. I. M. Kolthoff and F. T. Eggertsen (*J. Physical Chem.*, 1942, **46**, 458—463).—During the pre-ageing of colloidal $PbCrO_4$ desorption of stabilising $CrO_4^{\cdot\cdot}$ occurs and the greater is the amount of desorption the more rapidly does flocculated $PbCrO_4$ age. Thermal ageing of dry $PbCrO_4$ does not occur below 220° but with rise of temp. to 355° ageing becomes pronounced. C. R. H.

Effect of small concentrations of hexametaphosphate on iron oxide surfaces. F. Hazel (*J. Physical Chem.*, 1942, **46**, 516—524).—The stabilising effect on Fe_2O_3 sols of Na_3PO_4, $Na_4P_2O_7$, and $Na_6P_6O_{18}$ increases in this order. The effect of $CaCl_2$ on the flocculation and recharging vals. of phosphates for Fe_2O_3 sols has been investigated. The data suggest that the prevention of corrosion of Fe by the addition of these salts or of NaOH is directly associated with reversal of the charge on Fe_2O_3. C. R. H.

Frictional phenomena. VII. Viscosity of colloidal solutions. Application to synthetic polymers. A. Gemant (*J. Appl. Physics*, 1942, **13**, 90—96; cf. A., 1942, I, 51).—Theoretical. O. D. S.

The most suitable way of expressing viscosity, particularly of colloids. W. Philippoff (*Kolloid-Z.*, 1942, **98**, 90—92).—The various terms proposed for expressing η are reviewed and discussed, and it is recommended that the symbol $K = [\eta] = (d\eta_{rel}/dc)_{c\rightarrow 0}$ should be used, c being in g. per 100 c.c. The quantity K is independent of any particular theory, and can be used to characterise the viscous behaviour of any solution or suspension. F. L. U.

Viscosity and structure in hydrophilic colloids. II. C. Rossi (*Kolloid-Z.*, 1941, **97**, 304—313; cf. A., 1942, I, 296).—The variation of η with speed of rotation in a Couette viscometer was investigated for paraffin oil emulsions (I) and for bitumen emulsions (II) in the presence of Na oleate and NaOH. The influence of p_H, degree of dispersion, and of concn. was determined. In all cases the considerable differences observed at low speeds tend to disappear with increasingly higher speeds. The colloidal structures of (I) and (II) are similar, and for both η is related to the speed of rotation by $\eta = \eta_\infty + K/\Omega$ where η_∞ is the viscosity due to the normal intermol. forces in the liquid, Ω the angular velocity of the outer cylinder, and K a const. depending on the forces which orient the H_2O mols. around the dispersed particles. N. G.

Statistical thermodynamics of rubber. II. F. T. Wall (*J. Chem. Physics*, 1942, **10**, 485—488; cf. A., 1942, I, 204).—The author's theory, modified by the assumption that the total vol. remains const. during stretching, is in agreement with experimental data. Rubber should obey Hooke's law with respect to shear. L. J. J.

Absorption of water by rubber in relation to general problems of swelling. H. Veith (*Kolloid-Z.*, 1942, **98**, 52—62).—Experimental data on the rate of absorption of H_2O by commercial vulcanised rubber are summarised. It is suggested that absorption is determined by the difference between the v.p. of pure H_2O and that of an aq. solution of embedded H_2O-sol. substances; this leads to an approx. proportionality between rate of absorption and 1/(quantity of H_2O absorbed) in the initial stages, in agreement with observation. The elastic stresses accompanying swelling have little effect on the course of absorption with rubber, but with gelatin and other materials having a high degree of swelling their influence is considerable. An expression giving a relation between swelling pressure and concn. is derived and is in agreement with experimental data for gelatin. F. L. U.

Mechanism of deformation and fine structure of cellulose. XXI. Double refraction [caused] by extension of oriented isotropic cellulose fibres. XXII. Modification of the double refraction–extension relation for isotropic cellulose fibres by variation of the conditions of preparation. P. H. Hermans (*Kolloid-Z.*, 1942, **98**, 62—68, 69—70).—XXI. The sp. double refraction (δ_{sp}) of dry fibres of isotropic cellulose that have been previously stretched in the swollen condition, either in the xanthate stage or as hydrocellulose, increases with the degree of extension (E), and if E is referred to the dry state the δ_{sp}–E relationship is linear over a wide range and is the same for all degrees of swelling between 1·6 and 6·5. The max. δ_{sp} obtained with cellulose fibres is 0·033, and with xanthate fibres 0·040. The observations are not in accord with the theoretical relation deduced previously (cf. A., 1939, I, 470).

XXII. The increase of δ_{sp} with E is slower with fibres spun from a 4% viscose solution than with fibres from an 8% solution. F. L. U.

Mechanism of deformation and fine structure of regenerated cellulose. XX. High extensibility of cellulose gels. P. H. Hermans and P. Platzek (*Kolloid-Z.*, 1941, **97**, 329—335).—The max. experimental extensibility of isotropic cellulose threads swollen to various degrees first increases with increasing degree of swelling, reaches a max. of >200% at ~25% H_2O content, and then falls. These results confirm the theoretical conclusions reached previously (see above). The fact that the extensibility does not increase with increasing swelling shows that it is due not to real flow, but to the deformation of a network-like framework. The extensibility calc. relative to the dry state first rises rapidly with increasing swelling and then remains const. The vol. changes during extension and the double refraction of the extended threads were also measured. N. G.

Association and solvation among cellulose derivatives in organic liquids. I. Osmotic measurements. II. Viscosimetric measurements. E. Steurer (*Z. physikal. Chem.*, 1941, **A, 190**, 1—15, 16—23).—I. The dependence of osmotic pressure on concn. for solutions of ethylcellulose (I) in a no. of solvents has been studied. The results indicate that in strongly dissociating solvents like $CHCl_3$, CCl_4, and $CH_2Ph{\cdot}OH$, (I) is present as single mols., but in weakly dissociating solvents like C_6H_6, and PhMe it is associated, the degree of association

being 2—4. Addition of polar substances such as EtOH to the latter solutions causes dissociation.

II. Solutions in which (I) is associated have vals. of η and of its temp. coeff. respectively > and < those of solutions in which it is not associated. Addition of EtOH etc. to the former solutions causes a marked fall of η which continues after the dissociation is complete, and addition of EtOH etc. to solutions in which (I) is not associated also causes a fall of η. This effect is due to solvation of (I) by the added polar substance. F. J. G.

Macromolecular compounds. CCLXXII. Determination of mol. wt. XI. Lachs and Grosman on the osmotic determination of the mol. wt. of cellulose acetates. G. V. Schulz (*J. pr. Chem.*, 1941, [ii], **159**, 130—138).—The author criticises the work of Lachs and Grosman (cf. B., 1938, 43) and refutes their criticism. C. R. H.

Macromolecular compounds. CCLXXI. Mol. wt. determination and viscosity measurements of degraded cellulose triacetate. H. Staudinger and K. Eder (*J. pr. Chem.*, 1941, [ii], **159**, 39—69; cf. A., 1940, II, 69).—Measurements of η of solutions of purified and fractionated cellulose triacetate in *m*-cresol and in $CHCl_3$ show that for degrees of polymerisation (P) 20—50 the val. of K_m remains const. at 5—6 $\times 10^{-4}$. For cellulose in Schweitzer's reagent K_m = 5 $\times 10^{-4}$ for P ≮50. F. L. U.

Mechanical properties of substances of high mol. wt. II. Rigidities of the system polystyrene–xylene and their dependence on temperature and frequency. III. Viscosities of the system polystyrene–xylene. J. D. Ferry (*J. Amer. Chem. Soc.*, 1942, **64**, 1323—1329, 1330—1336).—II. Solutions of polystyrene in xylene support transverse vibrations and thus possess rigidity although they appear to be viscous liquids with no yield val. in static deformation. The propagation of transverse vibrations in such solutions has been studied between frequencies of 200 and 4000 cycles per sec. over a concn. range of 15·7 to 52·3% polymeride and from −5° to 40°. The dispersion of velocity at low concn. and the damping at high concn. are described and analysed in terms of a single relaxation time of ~4 $\times 10^{-4}$ sec., which is independent, to a first approximation, of temp. and composition. In the range studied the modulus of rigidity varies from 10^4 to 10^6 dynes per sq. cm. Its decrease with increasing temp. is characterised by a heat effect of 1·5 kg.-cal. The results are discussed in terms of the mol. behaviour of long-chain polymerides.

III. Vals. of η for solutions of concn. 15—52·3% have been determined at 1—30° and the dependence of η on shearing stress, temp., and concn. is discussed. Data for η and rigidity are interpreted by mol. mechanisms. W. R. A.

Dielectric investigation of polypeptides. I. Dielectric increments of amino-acid polypeptides. W. P. Conner, R. P. Clarke, and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 1379—1387).—The dielectric consts. of aq. solutions of twelve NH_2-acid polypeptides in the 10-m. λ region have been measured. Corresponding derived dielectric increments generally agree satisfactorily with recorded data. The effect of mol. vol. on the apparent increment vals. has been investigated and a method of correction has been worked out for the effect of the solvent when the solute mols. are approx. prolate spheroids. The vals. for the polyglycines deviate from the approx. linear dependence on the no. of glycine residues previously observed (Wyman *et al.*, A., 1933, 459; 1934, 475), but the results are still consistent with sufficient rotational freedom within the mols. to allow an approx. random distribution of the orientations about the valency bonds in the mols. In the various di- and tri-peptides investigated, the principal effect of side-chains on the mol. dipole moments appears to be that of modification of the solvent effect. W. R. A.

Stability of sodium glycinin sols. E. Volkov and I. Dvinjaninova (*J. Appl. Chem. Russ.*, 1941, **14**, 856—858).—The stability of 10% and 12% Na glycinin (I) sols on ageing at room temp. in the presence of 1·8—20·0% NaOH (calc. as % of the protein present) was investigated by measuring their surface tension (γ). γ decreases with increasing [NaOH]. 10% (I) sols are unstable at all [NaOH] investigated, the sols separating into two phases. The 12% sols are stable over the range 4·5—6·0% NaOH (calc. on the protein); below 4·5% NaOH, the sols tend to change to gels, whilst above 6·0% NaOH separation into two phases occurs at a rate which increases with increasing [NaOH]. N. G.

Calcium–protein relationships studied with the ultracentrifuge. I—III.—See A., 1942, III, 775.

Critical peptisation temperatures of zein in concentrated ethyl alcohol. R. H. Manley and C. D. Evans (*J. Biol. Chem.*, 1942, **143**, 701—702).—The crit. peptisation temp. has been determined for H_2O–EtOH mixtures containing 40—100% of EtOH. Between 92·5 and 100% EtOH the vals. given are really cloud points which may be up to 20° < the peptisation temp. In mixtures containing >60% of H_2O denaturation occurs before the dispersion temp. is reached. The min. crit. peptisation temp. is ~−5° at 73% EtOH concn. P. G. M.

Effect of electrical forces on stability of colloidal sols. W. G. Ever(ole and A. L. Hanson (*J. Chem. Physics*, 1942, **10**, 460—463).—The stabilising potential in a sol is identified with the potential at that distance from the solid surface for which the potential energy curve shows a max. It is a const. for a given sol in states of equal stability. L. J. J.

VI.—KINETIC THEORY. THERMODYNAMICS.

Gas equilibrium $\frac{1}{2}H_2 + \frac{1}{2}I_2 \rightleftharpoons HI$. (A) H. Zeise. (B) M. Bodenstein (*Z. physikal. Chem.*, 1941, **A**, **190**, 56—60, 60).—(A) A criticism of the work of Taylor and Crist (A., 1941, I, 335).

(B) This equilibrium is being re-investigated. F. J. G.

Gas equilibrium $2SO \rightleftharpoons \frac{1}{2}S_2^* + SO_2$. H. Zeise (*Z. physikal. Chem.*, 1942, **B**, **51**, 120—125).—K_p for the equilibrium $2SO \rightleftharpoons \frac{1}{2}S_2 + SO_2$ has been calc. using corrections suggested by Cross (A., 1936, 161) and hence vals. for the dissociation energy of SO and SO_2 have been derived and used to calculate K'_p for the reaction $2SO \rightleftharpoons \frac{1}{2}S_2^* + SO_2$. Two vals. for the heat of reaction have been obtained. The significance of these in reconciling the chemical and spectroscopic evidence is discussed. W. R. A.

Precipitation of hydrous cadmium hydroxide in the presence of certain anions. T. Moeller and P. W. Rhymer (*J. Physical Chem.*, 1942, **46**, 477—485).—Complex formation occurs when alkali is added to Cd solutions in presence of alkali salts. Complex stability is a function of the quantity of added anion and increases in the order $Cl' < SO_4'' < Br' < I'$. Complex formation increases the p_H at which pptn. begins, and pptn. can be prevented if sufficient added anion is present. C. R. H.

Dissociation constants of β-substituted phenylglutaric acids. I. N. L. Phalnikar and B. V. Bhide (*J. Univ. Bombay*, 1942, **10**, **A**, *Part* 5, 147—158).—The distances between the CO_2H groups have been calc. by Bjerrum's equation for several β-substituted phenylglutaric acids. The distances differ from those expected from the valency deflexion hypothesis, since the predominating inductive effect of the Ph renders Bjerrum's equation inapplicable. D. F. R.

Ionisation constants of propionic acid in methyl and ethyl alcohol–water mixtures from 0° to 40°. A. Patterson [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1942, **64**, 1480—1482).—E.m.f. measurements have been made on cells of the type H_2(1 atm.)|{$EtCO_2H(m_1)$, $EtCO_2Na(m_2)$, $NaCl(m_3)$} in x% aq. alcohol|AgCl–Ag, where x = 10 or 20. Vals. of the ionisation const. of $EtCO_2H$ in 10 and 20% MeOH and EtOH have been determined at 0°, 10°, 20°, 25°, 30°, and 40°. W. R. A.

Region of maximum buffer capacity. B. Park (*J. Chem. Educ.*, 1942, **19**, 171).—It is calc. that when a weak monobasic acid is titrated with a strong base the solution will show its greatest buffering capacity when the acid is half titrated. L. S. T.

Theory of the isoelectric point. II. T. L. Hill (*J. Physical Chem.*, 1942, **46**, 597—605; cf. A., 1942, I, 267).—The treatment previously employed is extended by the introduction of thermodynamic consts. The solubility of an ampholyte with one acidic and one basic group is a min. at an H· activity very near that corresponding with the isoelectric point; ionic strength is not a min. at this point. F. L. U.

Use of h and h' functions in calculating activity coefficients of strong electrolytes. Dependence of activity and activity coefficient on the concentration units. W. G. Eversole and T. F. Hart (*J. Physical Chem.*, 1942, **46**, 555—561).—Equations are given for the relation between solute activities and activity coeffs. on the N., molal, and mol. fraction concn. scales, and for the limiting val. of $h/r\mathfrak{f}$ and $h'/r\mathfrak{f}$ (r = mol. ratio of solute ions to solvent mols.) at infinite dilution. The h' function is the more useful for calculating activity coeffs. since the curve connecting $h'/r\mathfrak{f}$ with $r\mathfrak{f}$ does not pass through a max. in the dil. solution range, as does the corresponding curve for h. F. L. U.

Activity coefficients of some bivalent metal nitrates in aqueous solution at 25° from isopiestic vapour pressure measurements. R. A. Robinson, J. M. Wilson, and H. S. Ayling (*J. Amer. Chem. Soc.*, 1942, **64**, 1469—1471).—Osmotic and activity coeffs. have been calc. from isopiestic measurements on $Mg(NO_3)_2$, $Sr(NO_3)_2$, $Ba(NO_3)_2$, $UO_2(NO_3)_2$, $Co(NO_3)_2$, $Cu(NO_3)_2$, and $Cd(NO_3)_2$. In an extended treatment intermediate ion formation may prove to be an important factor for $Ca(NO_3)_2$, $Sr(NO_3)_2$, and $Ba(NO_3)_2$, but the others, especially $Mg(NO_3)_2$ and $UO_2(NO_3)_2$, can be treated as completely dissociated. $Cd(NO_3)_2$ does not show complex ion formation, which is so marked in Cd halides. W. R. A.

Simple and double sulphates of metals of the magnesium series. I. B. Fedoroff. **II. Cadmium, zinc, manganous, and ferrous sulphates, and their double sulphates with potassium.** N. Demassieux and B. Fedoroff (*Ann. Chim.*, 1941, [xi], **16**, 154—214, 215—236).—Electrical properties of solutions of Mg, Cu, Co, Ni, Zn, Cd, Mn^{II}, and Fe^{II} sulphates and of their K double sulphates have been investigated by measuring polarographically their cathodic decomp. potentials and by determining their equiv. conductivities. The activity coeffs. (γ) of the simple salts are almost the same, and < those of K_2SO_4, for a given concn., whilst γ vals. for the double salts are ≪ those

for the simple salts at the same concn. The degree of ionisation is greatest for $MgSO_4$, the other simple salts having smaller but closely similar vals.; this is also true of $K_2Mg(SO_4)_2$ compared with the other double sulphates. Ionisation consts. K calc. by the Onsager–Shedlovsky formula are satisfactory if the sulphates are regarded as 2—1 electrolytes in dil. solution and as 1—1 electrolytes in conc. solution. K for the simple sulphates decreases in the order Fe, Zn, Mg, Mn, Cd, Cu, Ni, Co, and for the double sulphates in the order Fe, Zn, Cd, Mn, Cu, Ni, Co. Dehydration curves for the solid salts are given. X-Ray diagrams made at 10° intervals from 20° to 400° show that over this range the double salts give no lines identical with those for the corresponding simple salts. F. L. U.

Equilibria in partly miscible liquids. G. Antonoff, M. Chanin, and M. Hecht (*J. Physical Chem.*, 1942, **46**, 492—496).—Data for changes of interfacial tension and d with time for the systems $Pr^{\beta}CO_2H$–H_2O, *iso*-C_5H_{11}·OH–H_2O, and *sec.*-BuOH–H_2O show that considerable time is required for the attainment of equilibrium, and that this attainment is not gradual but discontinuous. C. R. H.

Temperature-composition relations of the binary system manganous nitrate–water. W. W. Ewing and H. E. Rasmussen (*J. Amer. Chem. Soc.*, 1942, **64**, 1443—1445).—The solubility–temp. relations for the system $Mn(NO_3)_2$–H_2O have been investigated from 5° to 75° and 50—84% $Mn(NO_3)_2$. The hexa-, tetra-, di-, and mono-hydrates, but not the trihydrate, exist in equilibrium with H_2O solutions. W. R. A.

Affinity. C. (*a*) **System vanadium–phosphorus.** M. Zumbusch and W. Biltz. (*b*) **System niobium–phosphorus.** A. Reinecke, F. Wiechmann, M. Zumbusch, and W. Biltz. (*c*) **Comparison of the phosphides of vanadium, niobium, and tantalum.** M. Zumbusch and W. Biltz (*Z. anorg. Chem.*, 1942, **249**, 1—22).—(*a*) Tensimeter curves and X-ray diagrams for the system V–P indicate the existence of V_3P and VP_2 as well as of VP (cf. Chêne, A., 1939, I, 329) and possibly of two other *phosphides* intermediate between V_3P and VP. V_3P and VP have ρ_4^{25} 5·46 and 4·69, and the mol. vol. increment for P is 9·2 c.c.

(*b*) NbP forms solid solution with both Nb and P. It is isodimorphous with TaP. NbP_2 exists, but is easily dissociated. It is isodimorphous with VP_2 and TaP_2.

(*c*) The phosphides of V, Nb, and Ta are compared. F. J. G.

Vapour–liquid equilibria of non-ideal solutions. Utilisation of theoretical methods to extend data. H. C. Carlson and A. P. Colburn (*Ind. Eng. Chem.*, 1942, **34**, 581—589).—Methods of evaluating and extending vapour–liquid equilibrium data through the activity coeff. calc. from the equations of van Saar, Margules, and Scatchard and Hamer are developed. J. W. S.

Liquid–vapour composition of the boiling ternary solution ethyl alcohol–glycerol–benzene. W. Waring (*J. Physical Chem.*, 1942, **46**, 524—525).—Criticism of McDonald (cf. A., 1941, I, 266). C. R. H.

Equilibrium studies on pore-forming sulphides. III. R. Schenck and P. von der Forst (*Z. anorg. Chem.*, 1942, **249**, 76—87).—The equilibrium concn. ratios $[H_2S]/[H_2]$ over the systems Co–Sb–S and Co–Bi–S, and the isotherms for the systems at 450°, are recorded. NiS forms mixed crystals with both CoS and FeS, which have a lower S-tension than NiS. F. J. G.

System $FeSO_4$–H_2SO_4–H_2O over the range 50—90°. A. P. Belopolski and S. J. Schpunt (*J. Appl. Chem. Russ.*, 1941, **14**, 716—733).—The system $FeSO_4$–H_2SO_4–H_2O (*a*) was studied over the range 50—90° by analysis of the liquid and solid phases in equilibrium. In solutions less acid than 1% H_2SO_4, the $FeSO_4$ was subject to atm. oxidation; this was avoided by using H_2O saturated with N_2. The system $FeSO_4$–H_2O (*b*) was studied over the range −10° to 90°. In (*a*), the following salts were present: at 50°, $FeSO_4,7H_2O$ (**I**), $FeSO_4,4H_2O$ (**II**), $FeSO_4,H_2O$ (**III**), and $FeSO_4$ (**IV**); at 60°, (**II**), (**III**), and (**IV**); at 70°, (**III**) and (**IV**). The solubility of (**IV**) decreased with increasing $[H_2SO_4]$ in all cases except at the point of transition from (**III**) to (**IV**), when the reverse was observed. Approx. vals. are obtained for the dissociation pressure of $FeSO_4,H_2O \rightleftharpoons FeSO_4 + H_2O$ (0·4 mm. Hg at 50°, 0·5 mm. at 60°, 0·8 mm. at 70°, and 3·8 mm. at 90°). Contrary to Cameron (A., 1930, 683), $FeSO_4,2H_2O$ is not a stable phase in the systems (*a*) and (*b*). N. G.

Equilibrium studies in the system FeO–Al_2O_3–SiO_2. R. B. Snow and W. J. McCaughey (*J. Amer. Ceram. Soc.*, 1942, **25**, 151—160).—A modified quenching method was used to determine the liquidus surface for melts in Fe crucibles. The phases in equilibrium with liquids were: FeO,Al_2O_3 (**I**), $2FeO,SiO_2$ (**II**), cristobalite (**III**), tridymite (**IV**), $3Al_2O_3,2SiO_2$ (**V**), corundum (**VI**), and wüstite (approx. FeO); there was no evidence of the existence of an Fe pyroxene or of a ternary compound. Diagrams of the isotherms and μ of the glasses are given. Two quintuple points were observed, one being the eutectic of (**I**), (**II**), and (**IV**) at 970±20° (SiO_2 42, Al_2O_3 13, FeO 45%) and the other a peritectic of (**I**), (**IV**), and (**V**) at 1100±20° (SiO_2 48, Al_2O_3 23, FeO 29%). Crystallisation from the second melt without change in composition requires the redissolution of (**V**). The temp. and composition of the peritectic of (**I**), (**V**), and (**VI**) have not been determined. (**II**) and (**V**) are an incompatible pair the mutual fluxing of which gives (**I**) and (**IV**). J. A. S.

System $Ca(NO_3)_2$–$Sr(NO_3)_2$–H_2O at 25° and 60°. K. A. Kobe and P. B. Stewart (*J. Amer. Chem. Soc.*, 1942, **64**, 1301—1303).—Isotherms for the system at 25° and 60° have been determined. The solid phases at 25° are $Sr(NO_3)_2,4H_2O$, $Sr(NO_3)_2$, and $Ca(NO_3)_2,4H_2O$, and at 60° $Sr(NO_3)_2$ and $Ca(NO_3)_2$. W. R. A.

System $NaAlSi_3O_8$–$CaSiO_3$–$NaAlSiO_4$. W. R. Foster (*J. Geol.*, 1942, **50**, 152—173).—High-temp. equilibria in the systems $NaAlSi_3O_8$ (**I**)–$CaSiO_3$ (**II**), $NaAlSiO_4$ (**III**)–(**II**), and (**I**)–(**II**)–(**III**) have been investigated by the quenching method. Results are tabulated, and equilibrium diagrams given. L. S. T.

Solubility relations in the system $K_2Cr_2O_7$–KNO_3–KCl–H_2O. A. P. Palkin and P. S. Blagojavlenski (*J. Appl. Chem. Russ.*, 1941, **14**, 734—746).—The system $K_2Cr_2O_7$–KNO_3–KCl–H_2O was investigated over the range −5° to 40° by the polythermic method. Equilibrium was usually reached after 10—12 hr. continuous mixing. The results are expressed graphically by tetrahedral models, and the solid phases existing at the various concns. of the component salts determined. The quaternary system, as well as its component binary and ternary systems, are simple; the three salts present do not combine chemically and form neither hydrates nor solid solutions. Favourable conditions for the crystallisation of each salt are indicated. N. G.

System CaO–FeO–Al_2O_3–SiO_2. I. Quenching experiments on five joins. J. F. Schairer (*J. Amer. Ceram. Soc.*, 1942, **25**, 241—274).—Liquidus data are presented in detail for the quarternary system by neglecting the amount of Fe_2O_3 in the liquid and by plotting the total Fe as FeO on planes in a tetrahedron with CaO, Al_2O_3, SiO_2, and FeO as apices. The melts were made from the pure oxides in Pt crucibles, re-melted with pieces of pure Fe in Fe crucibles, and quenched for petrographic examination. The data indicate approx. the composition and temp. of 11 quaternary invariant points, covering a large portion of the tetrahedron. An equilibrium diagram is given for FeO–Al_2O_3–SiO_2. Examples are given to show how the data are of interest to ceramists, metallurgists, geologists, and petrologists. J. A. S.

Heats of formation of CrF_3, CrF_4, $CrCl_3$, and MgF_2. H. von Wartenberg (*Z. anorg. Chem.*, 1942, **249**, 100—112).—Heats of formation are recorded as follows: MgF_2, 261·4; CrF_3, 266·1; CrF_4, 20·4; $CrCl_3$, 132·6 kg.-cal. per g.-mol. CrF_3 is isomorphous with AlF_3. F. J. G.

Heats of catalytic hydrogenation in solution. I. Apparatus, technique, and heats of hydrogenation of pairs of stereo-isomerides. R. B. Williams (*J. Amer. Chem. Soc.*, 1942, **64**, 1395—1404).—The calorimetric determination of heats of catalytic hydrogenation at room temp. is discussed. The heats of hydrogenation of pairs of liquid stereoisomerides by gaseous H_2 agree with the rules of Kistiakowsky for the effect of substitution on the heat of hydrogenation of C:C. Heats of isomerisation have been computed and factors affecting stability are considered. The heat of complete hydrogenation of 1:2-dihydronaphthalene is > that of indene, in agreement with the work of Kistiakowsky (cf. A., 1937, I, 364). W. R. A.

Vapour pressure–temperature relations and heats of dissolution and dilution of the binary system manganous nitrate–water. W. W. Ewing, C. F. Glick, and H. E. Rasmussen (*J. Amer. Chem. Soc.*, 1942, **64**, 1445—1449).—V.p. data, including v.p. for the unsaturated, saturated, and supersaturated solutions and for mixtures of the crystals of two hydrates (4 and 6), are given for the system $Mn(NO_3)_2$–H_2O up to 24M. The heat of dissolution of $Mn(NO_3)_2$, and the heats of dilution of solutions of the salt up to 24M. have been measured. Partial molal heats of dissolution of H_2O in $Mn(NO_3)_2$ solutions (1·14—10·94M) have been computed from v.p. and thermal data. W. R. A.

Heat of reaction between methæmoglobin and salicylate.—See A., 1942, III, 774.

Specific heats and heats of dilution of concentrated sodium hydroxide solutions. H. R. Wilson and W. L. McCabe (*Ind. Eng. Chem.*, 1942, **34**, 558—566).—The sp. heats of 50·2—75·9 wt.-% NaOH solutions have been determined at 27—124° and the heats of dilution of 48·64—75·51 wt.-% solution at 93·3°. By combining the results with data for lower concns. an enthalpy–concn. chart is constructed for 0—80% NaOH solutions at various temp. J. W. S.

Dependence of heats of dissolution of some trichlorides on the concentration of hydrochloric acid. W. Klemm (*Z. anorg. Chem.*, 1942, **249**, 23—25).—An analysis of recorded data shows that the heats of dissolution of $AlCl_3$, $GaCl_3$, $InCl_3$, $FeCl_3$, and $LaCl_3$ decrease markedly with increasing [HCl]. P. J. G.

Heats of dissolution of the system sulphur trioxide–water. R. A. Morgen (*Ind. Eng. Chem.*, 1942, **34**, 571—574).—The partial mol. heats of dissolution of liquid SO_3 in H_2O have been recalc. from literature data and are tabulated. The application of the results in the calculation of the heats of dissolution, mixing, and dilution of any desired solution is illustrated by examples. J. W. S.

Entropy of the chloride ion. H. A. Bernhardt and H. D. Crockford (*J. Physical Chem.*, 1942, **46**, 473—476).—The abs. entropy of Cl' at 30° in solutions of HCl and six chlorides decreases from 27·1 to 18·9 e.u. as the concn. increases from 0·01M. to 1·0M. C. R. H.

Mollier diagrams for theoretical [ethyl] alcohol–air and octane–water–air mixtures. R. Wiebe, J. F. Shultz, and J. C. Porter (*Ind. Eng. Chem.*, 1942, **34**, 575—580).—Entropy charts permitting calculation of the temp., pressures, mean effective pressures, work, and efficiencies for the possible cycles for EtOH–air and C_8H_{18}–H_2O–air (H_2O = 35% of C_8H_{18}) mixtures are recorded. When full advantage is taken of the heats of vaporisation, lower temp. prevail with EtOH–air and C_8H_{18}–H_2O–air mixtures than with C_8H_{18}–air mixtures. J. W. S.

Equilibria of two-dimensional systems. I. H. H. Rowley and W. B. Innes (*J. Physical Chem.*, 1942, **46**, 537—548).—The treatment used is analogous to the classical treatment of three-dimensional equilibria. A general treatment of equilibria between insol. surface films and the underlying bulk phases leads to the conclusion that the chemical potentials in the surface phase are equal to those in the three-dimensional phase for the several components, but that the phase rule governing such equilibria is $F = C - P + 3$. Relationships involving entropies, heats, and reversible work of adsorption are derived for single-component systems. F. L. U.

Disperse structure of solid systems and its thermodynamic basis. VI. Application of the Gibbs–Thomson equation to crystals. D. Balarev (*Kolloid-Z.*, 1942, **98**, 43—45; cf. A., 1942, I, 290, 291).—No contradiction is involved between the author's contention that the disperse structure of solids is thermodynamically grounded and the fact that, *e.g.*, the equilibrium size of a crystal of $BaSO_4$ in aq. suspension is ~0·1 μ., since the conditions under which the Gibbs–Thomson equation is valid are not fulfilled for any real crystals. F. L. U.

Reaction kinetics and the second law [of thermodynamics]. E. Baur (*Helv. Chim. Acta*, 1941, **24**, 783—789).—A discussion of "unilateral equilibria" in which Guldberg's law is not obeyed, true reversibility of the forward and reverse reactions not being observed. Possible cases are distinguished by k–Δ curves of different types, Δ representing the degree of displacement of the system from equilibrium. Divergence from the second law in cases of anti-catalysis is discussed. A. J. E. W

Sources of thermodynamic data. Methods of application to the industry. J. G. Aston (*Ind. Eng. Chem.*, 1942, **34**, 514—521).—The methods of deriving free energy data from equilibrium data for <2 temp., obtained directly or by means of cells, from equilibrium data for one temp. combined with the heat of reaction and heat capacity data, from the third law of thermodynamics and heats of combustion, and from entropy and thermal data deduced by statistical mechanical methods from spectroscopic and mol. data are described. The methods are illustrated by calculations from data for the systems $C_2H_4 + H_2O \rightleftharpoons EtOH$ and $n\text{-}C_4H_{10} \rightleftharpoons iso\text{-}C_4H_{10}$. J. W. S.

Applications of thermodynamics to multicomponent systems. B. H. Sage and R. H. Olds (*Ind. Eng. Chem.*, 1942, **34**, 526—532).—The use of the fugacities of the components in predicting the phase behaviour of a multicomponent system is discussed and illustrated with data for mixtures of the lower paraffins. It is shown that the partial enthalpies of the components can be deduced from measurements on binary mixtures and the assumption of ideal solution behaviour in mixtures of paraffins. These permit the prediction of the energy transfer associated with changes of state under steady flow conditions. J. W. S.

Mathematical and physical importance of partial molar quantities and the derivation of the Duhem–Margules law. K. Fredenhagen (*Z. Elektrochem.*, 1942, **48**, 136—145).—Theoretical. C. R. H.

VII.—ELECTROCHEMISTRY.

Speed of transport of strong acids and bases in the electrolysis of their aqueous solutions. P. Jolibois, F. Fer, and R. Lateulade (*Compt. rend.*, 1941, **213**, 993—996).—Apparatus is described for the measurement of the velocity of cataphoresis of strong acids and bases. This velocity corresponds closely with the mobility of the anion (acids) or the cation (bases) for HCl, H_2SO_4, LiOH, NaOH, and KOH. A. J. M.

Hydrogen, calomel–hydrochloric acid, and mercurous sulphate electrodes. F. Müller and H. Reuther (*Z. Elektrochem.*, 1942, **48**, 220—227, 337—338).—Several cells incorporating these electrodes have been constructed and the usual electrochemical consts. determined. C. R. H.

Contact potentials. III. The voltaic cell. IV. The concentration cell. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], **33**, 496—505, 506—513; cf. A., 1942, I, 268).—The theory of contact potentials is adequate to explain the phenomena of the voltaic cell and can be used to deduce the concn.-cell relation. A concn. thermojunction conforms to a law of intermediate concns. but not to a law of intermediate metals. L. J. J.

VIII.—REACTIONS.

Limits of inflammability and ignition temperatures of nicotine in air. G. W. Jones, G. S. Scott, and W. E. Miller (*U.S. Bur. Mines*, 1942, *Rept. Invest.* 3640, 5 pp.).—Mixtures containing 0·75—4·00 vol.-% of nicotine (I) in dry air at 100·5—139·5° and ordinary pressures are inflammable. The ignition temp. of (I) is 244° in air and 235° in O_2. M. H. M. A.

Kinetics of the formation and decomposition of di*cyclo*pentadiene.—See A., 1942, II, 279.

Halogenation of phenolic ethers and anilides. XII. Some Arrhenius activation energies. B. Jones (*J.C.S.*, 1942, 418—420).—Data for the rate (k) of chlorination of 21 ethers of the type p-OR·C_6H_4X (R = alkyl or substituted CH_2Ph group, X = F, Cl, Bz, OBz, or NO_2) show that changes in k due to modifications in R and X are due to activation energy changes. C. R. H.

Temperature variation of the rates of reaction of monochloro-, monobromo-, and monoiodo-acetic acids with water. F. Kunze and H. Merkader (*Z. physikal. Chem.*, 1940, **A**, **187**, 285—288).—The velocities of reaction of $CH_2Cl\cdot CO_2H$, $CH_2Br\cdot CO_2H$, and $CH_2I\cdot CO_2H$ with H_2O have been determined at 320—370° and the heats of activation and action consts. of the reactions are calc. The action consts. are in the same ratio as the quantum yields of the respective photochemical reactions. This observation is discussed. J. W. S.

(A) Hydrolysis of acetyl and chloroacetyl chlorides. (B) Relations between affinity and reaction velocity. (C) Organic reactions. Reaction velocity as an indication of molecular structure. J. M. González Barredo (*Anal. Fis. Quím.*, 1941, **37**, 274—277, 278—281, 282—290).—(A) Contrary to Velasco and Borbolla (A., 1936, 940) the reaction is not unimol. as the order varies between 0 and 2. Their conclusions are therefore disputed.

(B) The reactions between quinones and diphenylsemicarbazides are not bimol. and the conclusions of Velasco (A., 1935, 709) are therefore invalid.

(C) Contrary to Velasco and Borbolla (A., 1937, I, 142), the hydrolysis of AcCl and $CH_2Cl\cdot COCl$ is accompanied at least by diffusion and there is no evidence for a simple relation between the velocity of hydrolysis and the dissociation consts. of the corresponding acids. F. R. G.

Reaction velocity in heterogeneous liquid–liquid systems. D. D. Karve (*J. Univ. Bombay*, 1942, **10**, **A**, *Part* 5, 159—166).—A review. D. F. R.

Rate of reduction of vanadium pentoxide in concentrated acid solutions. Reduction of vanadium pentoxide by arsenious acid, oxalic acid, formaldehyde, and ethyl alcohol. M. Bobtelsky and A. Glasner (*J. Amer. Chem. Soc.*, 1942, **64**, 1462—1469).—The velocities of reaction between V^V ions and As_2O_3, $H_2C_2O_4$, CH_2O, and EtOH have been investigated. Except for $H_2C_2O_4$, strong acids always accelerate the reaction. Results are compared with those obtained with the various reducing agents, and also the effects of various accelerators. Mn^{II} and Fe^{III} ions are sp. catalysts for the oxidation of $H_2C_2O_4$. The catalytic effect of H_3PO_4 seems to be connected with the As_2O_3 and not with the V. HNO_3 is a peculiar and very sensitive inductor in presence of CH_2O and EtOH. W. R. A.

Influence of the crystalline lattice of an oxide on the speed of reduction with hydrogen. G. I. Tschufarov and G. F. Vilesova (*Teor. i Prakt. Met.*, 1936, No. 4, 10—17).—Above 600° the ultra- and micro-porosity of the magnetite reduction products is small. This blocks the penetration of the gas, and reduction is hindered. Below 600° magnetite is sometimes reduced more rapidly than hæmatite. Ch. Abs. (*e*)

Kinetics of chain polymerisation. XIV. Polymerisation of methyl methacrylate under the influence of benzoyl peroxide. G. V. Schulz and F. Blaschke (*Z. physikal. Chem.*, 1942, **B**, **51**, 75—102).—The velocity of polymerisation and the degree of polymerisation in relation to concns. of peroxide and of monomeride, temp., and time have been measured for pure ester and for its C_6H_6 solution. A reaction mechanism, involving a two-stage decomp. in the primary act and formation of an intermediate product between the peroxide and the monomeride, is proposed. The idea that the peroxide decomposes into radicals has been disproved. W. R. A.

Formaldehyde condensation as organic autocatalysis.—See A., 1942, II, 299.

Addition polymerisation catalysed by substituted acyl peroxides.—See A., 1942, II, 304.

Oxidation by copper in alcoholic medium. E. M. Mystkowski (*Nature*, 1942, **150**, 234).—Ascorbic acid in EtOH is oxidised in presence of $CuSO_4$; NaCl is strongly inhibitory. $CuSO_4$,C_5H_5N is even more active, and C_5H_5N alone has a catalytic effect. Solubilities in abs. EtOH at 17° are: $CuSO_4$ 0·009, $CuSO_4$,$5H_2O$ 0·0045, $CuSO_4$,C_5H_5N 0·022%. A. A. E.

Gallium chloride as a catalyst. H. Ulich (*Angew. Chem.*, 1942, **55**, 37—38).—The author's investigations on the substitution of $GaCl_3$ for $AlCl_3$ in the Friedel–Crafts reaction are reviewed. C. R. H.

Catalytic decomposition of hydrogen peroxide by basic beryllium iodide hydrosols. B. Cohen (*J. Amer. Chem. Soc.*, 1942, **64**, 1340—1341).—The catalytic effect of the I′ ion adsorbed by colloidal BeO on the decomp. of H_2O_2 is > that of the free I′ ion. W. R. A.

Copper chromite compounds as catalysts for the combustion of carbon monoxide. I. R. Ladisch and A. Simon (*Z. anorg. Chem.*, 1941, **248**, 137—154).—An almost amorphous prep. of $CuCr_2O_4$, obtained by thermal decomp. of $(NH_4)_2[Cu(CrO_4)_2(NH_3)_2]$, is an effective catalyst for the oxidation of CO at 20—130°, and is not poisoned by H_2O vapour. At >150° its activity decreases as a result of firm adsorption of CO. At >200° irreversible changes involving recrystallisation occur. F. J. G.

Kinetics of oxidation of ammonia by air enriched with oxygen. V. I. Atroschtschenko and E. G. Sedascheva (*J. Appl. Chem. Russ.*, 1941, **14**, 500—506).—Higher concns. of NH_3 can be used, and a higher yield of NO is obtained, if O_2 is added to the air employed for oxidation. With Pt–Rh (93 : 7) wire catalyst, the best conditions are: 850—900°, NH_3 14, O_2 28%; if the gas speed is such that 1050 kg. of NH_3 are converted in 24 hr. per 1 sq. m. of the catalyst surface, the yield is 95—96%. J. J. B.

Reactions of hydroxylamine and the catalytic ammonia oxidation of Bodenstein. M. Bodenstein, W. Krauss, and A. von Nagel (*Z. Elektrochem.*, 1942, **48**, 167). C. R. H.

Catalytic hydrogenation of heptaldehyde in [the] vapour phase. T. J. Suen and S. Fan (*J. Amer. Chem. Soc.*, 1942, **64**, 1460—1462).—C_6H_{13}·CHO was hydrogenated at 250° under atm. pressure with a Ni catalyst; *n*-C_6H_{14} was the main product, some *n*-C_7H_{15}·OH also being obtained. The CO formed was partly reduced to CH_4. W. R. A.

Catalytic activity of an intermetallic compound of cadmium and copper in the vapour-phase reduction of nitrobenzene. R. J. Grim (*J. Physical Chem.*, 1942, **46**, 464—469).—Although Cd_3Cu_2 is an effective catalyst for the vapour-phase reduction of $PhNO_2$ to NH_2Ph, the yield at most temp. is < that obtained with Cd or Cu separately. C. R. H.

Activation of metals by foreign addenda. IV. Silver. R. Schenck, H. Keuth, and S. Süss (*Z. anorg. Chem.*, 1942, **249**, 88—99).—Equilibrium data for the systems Ag–Cr–O and Ag–V–O at 500°, and Ag–Mn–O at 600°, are recorded. Mixtures of finely-divided Ag with Cr_2O_3, Mn_2O_3, or V_2O_3 readily absorb O_2 at moderate temp. affording $Ag_2Cr_2O_4$, $Ag_2Mn_2O_4$, and Ag_3VO_4. In presence of excess of Ag, $Ag_2Cr_2O_4$ is further oxidised to Ag_2CrO_4, whereas this in presence of excess of Cr_2O_3 readily loses O_2 affording $Ag_2Cr_2O_4$. Rh_2O_3 behaves like the other sesquioxides, and mixtures of finely-divided Rh and Ag are readily oxidised by heating in air to $Ag_2Rh_2O_4$. F. J. G.

Condensation of ketones with alcohols in the presence of mixed catalysts.—See A., 1942, II, 299.

Influence of external factors in catalytic reactions. Dehydrogenation of ethyl alcohol with copper catalyst.—See B., 1942, II, 305.

Building up of catalysts for destructive hydrogenation.—See B., 1942, II, 305.

Electrolytic [preparation of a] solution of sodium hypochlorite. W. Swallow and T. D. Whittet (*Pharm. J.*, 1942, **149**, 14).—By electrolysis of 18% aq. NaCl, using a C cathode and Pt anode, a solution containing 0·5—0·55% of available Cl can be obtained in 4 hr. The efficiency of the process increases slightly with time of passage of the current. The solution obtained is suitable for use in the treatment of burns. J. W. S.

Electrolytic preparation of barium perchlorate. E. S. Beinarovitsch and V. V. Stender (*J. Appl. Chem. Russ.*, 1941, **14**, 494—499).—A solution of 250 g. of $BaClO_3$ containing ≯5 g. of $BaCl_2$ is electrolysed at 20—25° between Pt electrodes. The anodic c.d. is 3 amp. per sq. cm. at the beginning, and 1 amp. per sq. cm. at the end of electrolysis; the cathodic c.d. is 1 amp. per sq. cm. J. J. B.

Iodine reaction and a mercury reaction of photographic importance. A. Steigmann (*J.S.C.I.*, 1942, **61**, 82—84).—A freshly prepared mixture of $FeCl_3$ and $K_3Fe(CN)_6$ is a sp. reagent for I if the halides present are separated as Ag halides and treated with the reagent. AgI gives an immediate blue colour, AgBr turns blue very slowly, and AgCl is unaffected. Alkali iodides give the test but not the bromides and chlorides. The same colour is also given by Ag_2S, Ag, and other metals. Traces of Hg can be detected by their catalytic effect on the reduction of $AgNO_3$ by hot dil. aq. SO_2. The relationship between these tests and the production of the latent image, and photographic Hg-densitisation, respectively, is discussed. J. W. S.

Photochemical decomposition of solutions of ascorbic acid in the ultra-violet. (Mlle.) S. Guinand (*Compt. rend.*, 1941, **213**, 1003—1004).—The decomp. of ascorbic acid by ultra-violet irradiation is due to rays in the far ultra-violet, probably 1942 and 1849 A., and not to 2537 A., as has formerly been supposed. A. J. M.

Effect of ultrasonic waves on the velocity of corrosion of copper. J. A. Hedvall and O. Jönsson (*Naturwiss.*, 1941, **29**, 726—727).—Well polished Cu rods were placed in an atm. of I or H_2S. The time taken for the corrosion layer to reach a given thickness was shorter when the reaction was carried out with the Cu rod vibrating at ultrasonic frequencies than under ordinary conditions. A. J. M.

IX.—METHODS OF PREPARATION.

Chemical processes in which solids participate. Sintering processes in powders consisting of a single component. Processes of metal ceramics and oxide ceramics. III (2). G. F. Hüttig (*Kolloid-Z.*, 1942, **98**, 6—33; cf. A., 1942, I, 152, 160).—A summary, with bibliography, of experimental data on the changes undergone by powders during slow heating. F. L. U.

Components of Fehling's solution. J. G. N. Gaskin (*Analyst*, 1942, **67**, 213—219).—Complex formation in solutions of mixtures of $CuSO_4$, NaOH, and K_2T, Na_2T, or KNaT ($T = C_4H_4O_6$) was studied by means of their polarisation. Two complexes, CuT,2Cu$(OH)_2$ and CuT,4Cu$(OH)_2$, are stabilised respectively by 1 or 2 mols. of tartrate and 1—4 mols. of tartrate. A strongly lævorotatory compound of the type CuT,4Cu$(OH)_2$ + Na_2T was isolated. In addition CuT was shown to be sol. in excess of alkali tartrate solutions. Improvements in the composition of Fehling's solution for analytical work are suggested. S. B.

Copper, nickel, and uranyl compounds of ethylenediaminetetra-acetic acid. H. Brintzinger and G. Hesse (*Z. anorg. Chem.*, 1942, **249**, 113—118).—The following *compounds* are described: H_2[CuR], H_2[NiR], $(UO_2)H_2R,H_2O$ (R = $[CH_2{\cdot}N(CH_2{\cdot}CO_2{\cdot})_2]_2$). F. J. G.

Silver thiosulphate complexes in aqueous solution—a correction. O. Schmitz-Dumont and E. Schmitz (*Z. anorg. Chem.*, 1941, **248**, 208).—The formula given as $Na_3[Ag(S_2O_6)_2],H_2O$ (*ibid.*, **247**, 36) should read $Na[Ag_3(S_2O_3)_2],H_2O$. F. J. G.

Oxidation of magnesium sulphide by carbon dioxide. A. Chrétien and K. Nielsen (*Compt. rend.*, 1941, **213**, 574—577).—MgS is almost completely converted into MgO by CO_2 at 700°/150—200 mm.; CO, S, and COS are formed, the COS by a secondary reaction between CO and S. A. J. E. W.

Preparation of magnesium thiosulphate. J. I. Zilberman and I. L. Chmelnitzkaja (*J. Appl. Chem. Russ.*, 1941, **14**, 492—493).—$MgS_2O_3,6H_2O$ is obtained in a 55—70% yield when to a solution of 45 g. of $Na_2S_2O_3,5H_2O$ in 15 c.c. of H_2O a mixture of 90 g. of $Na_2S_2O_3,5H_2O$ and 150 g. of $MgCl_2,6H_2O$ is gradually added at 75—80°; it is deposited on cooling the filtrate from NaCl. J. J. B.

Reactions in the solid state at high temperatures. XXVIII. Intermediate states which appear in the formation of magnesium vanadate in the solid state. W. Jander and G. Lorenz (*Z. anorg. Chem.*, 1941, **248**, 105—117).—When mixtures of MgO and V_2O_5 are ignited at various temp., the first loose surface binding occurs at 350° and corresponds with max. of ease of dissolution, sorptive power, and hygroscopicity. At higher temp. the surface binding becomes firmer, corresponding with a decrease of these properties, until at 530° they show a second sharp max., and also a max. of catalytic power for the oxidation of SO_2. At this temp. the first *X*-ray lines of MgV_2O_6 appear. F. J. G.

Preparation and stabilisation of calcium thiosulphate. J. I. Zilberman and I. L. Chmelnitzkaja (*J. Appl. Chem. Russ.*, 1941, **14**, 486—491).—$CaS_2O_3,6H_2O$ is obtained in a 50—60% yield when to 70 g. of $CaCl_2$ (85%) in 40 c.c. of H_2O 140 g. of $Na_2S_2O_3,5H_2O$ are slowly added at 46—48°. The salt is unstable both in solution and as crystals (even if kept under Et_2O) but is stabilised by heating a 10% solution for 10 min.—2 hr. at 80—100° and keeping the sterile solution in a CO_2-free atm. J. J. B.

Decomposition temperatures of some analytical precipitates. Barium carbonate. M. L. Nichols and R. H. Lafferty, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 481—485; cf. A., 1941, I, 343).—The dissociation of $BaCO_3$ has been investigated by the gas-saturation method of determining v.p. $BaCO_3$ begins to lose wt. at 860°, but, under the conditions described, it can be ignited for a short time at 885°, without affecting the accuracy of an analytical determination. L. S. T.

Protection of radium during air raids. Anon. (*U.S. Bur. Stand. Handbook*, 1942, No. H 38).—Measures for the protection and salvage of Ra are recommended. A. A. E.

Chromatographic adsorption in the chemistry of phosphorescent substances. E. Tiede and W. Schikore (*Ber.*, 1942, **75**, [*B*], 586—589).—Zn, Ca, Sr, Ba, and Mg salts can be efficiently purified by passage over Al_2O_3 (Brockmann). H. W.

Chromatographic methods in inorganic chemistry. II. H. Erlenmeyer and W. Schoenauer (*Helv. Chim. Acta*, 1941, **24**, 878—879; cf. A., 1940, I, 79).—Violuric acid, used alone or mixed with kieselguhr, $BaSO_4$, or preferably starch, is a suitable adsorption medium for chromatographic separation of inorg. cations, the salts formed having a wide variety of colours. The separation is effected with salts of a weak acid (*e.g.*, AcOH). Separation of K, Ca, Mg, and Na cations simultaneously and of the following cation pairs is

reported: K–Na, NH_4–Na, K–NH_4, K–Mg, Mg–Na, NH_4–Mg, Ba–Ca, Ba–Sr, Sr–Ca, Cu–Hg^{II}, Pb–Hg^{II}, and Cu–Pb. A. J. E. W.

Fine structure of the alkaline-earth sulphide phosphors. E. Tiede [with W. Schikore] (*Ber.*, 1942, **75**, [*B*], 589—590).—Activation of highly purified ZnS by intrusion of Cu occurs at 330—350°; the corresponding temp. for chromatographed CaS and SrS are 510° and ~460° respectively. H. W.

Polyborates. III. Alkylammonium borates. A Ferrari and L. Coghi (*Gazzetta*, 1941, **71**, 129—135).—The following are prepared from boric acid and the appropriate amine in H_2O: *methylammonium decaborate*, $R_2B_{10}O_{16},8H_2O$, and *dimethyl-*, *trimethyl-*, *ethyl-*, *diethyl-*, and *triethyl-ammonium decaborate*, $R_2B_{10}O_{16},4H_2O$ (R = alkylammonium). Hydration of alkylammonium salts is discussed. E. W. W.

Basic aluminium chlorides. H. W. Kohlschütter and P. Hantelmann [with K. Diener and H. Schilling] (*Z. anorg. Chem.*, 1941, **248**, 319—344).—Solutions having the compositions $AlCl_3,2Al(OH)_3$ and $AlCl_3,5Al(OH)_3$ represent stable and reproducible equilibria, the former containing a trinuclear and the latter a hexanuclear cation. On addition of alkali to $AlCl_3$, the former equilibrium is set up only slowly, but the latter is derived quickly from the former, so that rapidly pptd. $Al(OH)_3$ corresponds with the neutral salt (monomeric cation) whereas slowly pptd. $Al(OH)_3$ is derived from the hexanuclear cation. These two hydroxides show characteristic differences in their behaviour with acids and alkalis. Addition of C_2O_4'' to basic Al chloride solutions removes Al''' ions as an oxalato-complex until the hexanuclear cation has been formed, when this is pptd. as a basic oxalate having C_2O_4 : Al = 3 : 12. F. J. G.

Gallium salts. E. Einecke (*Angew. Chem.*, 1942, **55**, 40—42).—A review. C. R. H.

Volatile gallium hydride Ga_2H_6. E. Wiborg and T Johannsen (*Angew. Chem.*, 1942, **55**, 38—40).—By action of the glow discharge on mixtures of H_2 and $GaMe_3$, liquid $Ga_2H_2Me_4$ is formed which decomposes at 130°. When $Ga_2H_2Me_4$ reacts with NMe_3, Ga_2H_6 (m.p. −21·4°) is one of the reaction products. Ga_2H_6 decomposes at 130°. C. R. H.

Isolation of radioactive yttrium and some of its properties in minute concentrations. J. D. Kurbatov and M. H. Kurbatov (*J. Physical Chem.*, 1942, **46**, 441—457).—457).—Methods for the separation of radioactive Y (^{86}Y) without stable Y from Sr and Fe and the conditions for its removal from solutions of minute concn. have been investigated. The amount of Y removed from solution and the amount remaining are determined by the p_H of the solution and by the concn. of other salt, *e.g.*, NH_4Cl, these factors acting in opposite directions. For this reason Y is not necessarily removed from solution nor, on the other hand, does it necessarily remain in solution when the concn. is respectively above or below that corresponding with the solubility product of $Y(OH)_3$. C. R. H.

Position of yttrium in the series of the lanthanides. H. Bommer (*Z. anorg. Chem.*, 1941, **248**, 397—401).—The position of Y in the serial order of the rare earths varies according to the properties being considered. Theoretical interpretations are given. F. J. G.

Indium salts. R. Juza (*Angew. Chem.*, 1942, **55**, 45—47).—A review.

Indium salts. I. F. Ensslin and H. Dreyer (*Z. anorg. Chem.*, 1942, **249**, 119—132).—The following *In salts* are described: $InCl_3,4H_2O$; $InBr_3,5H_2O$; Na_3InF_6 (**I**); $InCl_3,2MgCl_2,12H_2O$; $In[Co6NH_3]Cl_6$ (**II**); $In[Co\,en_3]Cl_6,2H_2O$, $[NEt_2{\cdot}CS_2]_3In$ (**III**). Solubilities (% at 22°) are recorded as follows: InF_3, 7·83; $InCl_3$, 64·7; $InBr_3$, 84·3; InI_3, 91·6; (**I**), 8·33; (**II**), 1·01. (**II**) is almost insol. in dil. HCl, and it and (**III**) are suitable for gravimetric determination of In. F. J. G.

Rare-earth metal amalgams. I. Reaction between sodium amalgam and rare-earth acetate and chloride solutions. J. K. Marsh (*J.C.S.*, 1942, 398—401).—When Sm, Eu, or Yb acetates, in dil. AcOH, are treated with dil. Na amalgam, 100% conversion into the rare-earth amalgam is obtained if the Na is equal in wt. to the rare-earth oxide used. Higher amalgam yield but lower efficiency is obtained by using acid chloride solutions. The yields of amalgam are also considerable with La, Ce, Pr, and Nd, but generally decrease with increasing at. wt. and become negligible for Gd. Eu amalgam and HCl yield solid $EuCl_2$, but this salt does not exchange metal quantitatively with Na amalgam. Evidence is obtained that with H_2O Eu amalgam yields a sol. $Eu(OH)_2$. The applications of amalgam formation in the separation of rare-earth metals are discussed. J. W. S.

Lanthanum oxyfluoride. W. Klemm and H. A. Klein (*Z. anorg. Chem.*, 1941, **248**, 167—171).—LaOF has the CaF_2 structure with *a* 5·756 A. It takes up >2 mol.-% of La_2O_3, with distortion to a tetragonal lattice, but dissolves considerable amounts of LaF_3, forming a series of solid solutions in which the lattice const. changes only slightly. F. J. G.

Chemistry of germanium with special reference to its similarity to related elements. R. Schwarz (*Angew. Chem.*, 1942, **55**, 43—45).—A review. C. R. H.

Thorium sulphide. E. F. Strotzer [with M. Zumbusch] (*Z. anorg. Chem.*, 1941, **247**, 415—428).—ThS_2 and Th_3S_7 have been prepared in a pure state by direct synthesis at 600—800°. ThS_2 is lilac-brown, and Th_3S_7 deep red. Both are stable towards H_2O, dil. NaOH, dil. HCl, and dil. H_2SO_4, and slightly attacked by hot conc. H_2SO_4. Th_3S_7 is slightly attacked by hot conc. HCl, and both are readily sol. in dil. or conc. HNO_3 or HCl + HNO_3. *X*-Ray examination of products with less S reveals the existence of Th_2S_3 and ThS, neither of which has been obtained pure. *X*-Ray spectra of the four sulphides are given. F. L. U.

Formation of nitrogen dioxide during the thermal decomposition of ozone in presence of nitrogen. D. Barbier and O. Chalonge (*Compt. rend.*, 1941, **213**, 1010—1012).—NO_2 is formed when O_3 is passed with N_2 through a hot tube. A. J. M.

Action of certain solutions of salts on alkaline-earth arsenates. H. Guérin (*Compt. rend.*, 1941, **213**, 1012—1015).—The addition of Ca arsenates to solutions of chlorides, nitrates, and acetates gives rise to various reactions, including double decomp., exchange of ions, hydrolysis, and occasionally simple dissolution. Sr arsenates are relatively sol. in solutions of NH_4 salts, and tend to give double salts. With Ba arsenates, simple dissolution usually occurs. A. J. M.

Amides of tervalent chromium and cobalt. O. Schmitz-Dumont, J. Pilzecker, and H. F. Piepenbrink (*Z. anorg. Chem.*, 1941, **248**, 175—206).—Cr^{III} and Co^{III} *amides*, $[Cr(NH_2)_3]_n$ and $[Co(NH_2)_3]_n$, have been obtained by interaction of KNH_2 with $[Cr(NH_3)_6](NO_3)_3$ and $[Co(NH_3)_6](NO_3)_3$ in liquid NH_3. They are amorphous ppts., containing traces of KNH_2 which cannot be removed by washing. With NH_4 salts in liquid NH_3 they afford the *compounds* $[Br(NH_2)Cr(NH_3)_3]_nBr_n$, $[(NO_3)(NH_2)Cr(NH_3)_3]_n(NO_3)_n$, $[(NH_2)_2Co(NH_3)_2]_n(NO_3)_n$, $[(NO_3)(NH_2)_2Co(NH_3)]_n$, and with KNH_2 in liquid NH_3 the *compounds* $[Cr(NH_2)_4]_nK_n$, $[(NH)Cr(NH_2)_2]_nK_n$, and $[Co_2N_3]_nK_n$. All of these compounds are amorphous to *X*-rays and are high polymerides. They oxidise rapidly in air and are sometimes pyrophoric. With H_2O they afford at first clear solutions which soon hydrolyse. F. J. G.

Molybdenum trisulphide. W. Biltz and A. Köcher (*Z. anorg. Chem.*, 1941, **248**, 172—174).—The reaction $MoS_3 = MoS_2 + S$ is irreversible. F. J. G.

Molybdenum sulphides. J. Méring and A. Lévialdi (*Compt. rend.*, 1941, **213**, 798—800).—Thermal decomp. of NH_4 sulphomolybdate (**I**) at 1000° affords MoS_2. Below 800°, (**I**) yields MoS_{2+x} ($x = 0$—0·5). Debye–Scherrer *X*-ray diagrams (Cu $K\alpha$ rays) show that MoS_2 has the same structure as natural molybdenite (**II**) (cf. A., 1923, ii, 571). MoS_{2+x} is a homogeneous phase with the same structure as (**II**) but distorted. The distortion increases with *x* and is shown by progressive disappearance of diffracted rays. *a* is const. (3·15 A.) but *c* increases slightly as S increases. The variable composition also suggests a structure lacking some Mo atoms in the lattice, which is confirmed by comparison of calc. and observed *d*. C. S.

Fluorine. H. J. Emeléus (*J.C.S.*, 1942, 441—447).—A lecture. C. R. H.

Electrolytic solution of sodium hypochlorite. J. Carey (*Pharm. J.*, 1942, **149**, 62; cf. A., 1941, III, 280).—Aq. NaOCl is stabilised by removal of free Cl_2 with a slight excess of NaOH or Na_2CO_3. M. H. M. A.

Chlorites. J. F. White, M. C. Taylor, and G. P. Vincent (*Ind. Eng. Chem.*, 1942, **34**, 782—792).—Decomp. of $HClO_2$ (**I**) in the sense: $4HClO_2 \rightarrow 2ClO_2$ (**II**) + $HClO_3$ (**III**) + HCl + H_2O usually gives vals. for (**II**)/(**III**) >2 (2·1—2·7), except at p_H 7 when (**III**) is almost exclusively formed. The vals. are not reproducible and do not vary with temp. or p_H (0·5—5·9). The rate of decomp. increases rapidly at p_H <4·2. (**I**) and HOCl (**IV**) give (**II**) initially, followed by secondary slow formation of (**III**). Increase of p_H favours formation of (**III**). (**I**) + CH_2O give (**II**) + some (**III**) + CO_2 (similarly MeCHO, PhCHO, $FeSO_4$). (**I**) is superior to (**IV**) in bleaching wood pulp and textiles, causing less degradation and loss of fibre strength. M. H. M. A.

Rôle of water in reactions at low temperature between ferric oxide and metallic monoxides. (Mlle.) J. Longnet (*Compt. rend.*, 1941, **213**, 577—579; cf. A., 1939, I, 482).—Dried, co-pptd. mixtures of hydrated NiO, CoO, ZnO, or CuO and Fe_2O_3,nH_2O do not react when suspended in boiling EtOH or PhMe, although a ferrite, $MIIO,Fe_2O_3$, is formed in boiling H_2O. The co-pptd. Fe_2O_3,nH_2O inhibits dehydration and crystallisation of CuO,nH_2O at 100°, which would otherwise prevent ferrite formation; NiO, CoO, and ZnO remain in the amorphous, hydrated condition at 100°, and ferrite formation proceeds with Fe_2O_3,nH_2O added after pptn. The hydrated oxides also combine in H_2O vapour at 150°. The observations may explain hydrothermal formation of certain minerals (*e.g.*, franklinite). A. J. E. W.

Reactions of organometallic compounds with iron pentacarbonyl and iron carbonyl hydride. W. Hieber (*Z. anorg. Chem.*, 1941, **248**, 402—403).—Attempts to isolate "mixed organometallic carbonyls,"

having org. radicals linked to the same metallic atom as CO, have all failed (cf. *ibid.*, 84). F. J. G.

Organometallic carbonyls. F. Hein (*Z. anorg. Chem.*, 1941, **248**, 404).—A reply to Hieber (cf. preceding abstract). F. J. G.

Metallic carbonyls. XLI. Formation of iron, cobalt, and nickel carbonyls by high-pressure synthesis from halides. W. Hieber, H. Behrens, and U. Teller (*Z. anorg. Chem.*, 1942, **249**, 26—42).—In the synthesis of carbonyl compounds from Fe, Co, and Ni halides and CO under pressure, the yields with the iodides are $\gg$ with the chlorides or bromides. The intermediate formation of $Fe(CO)_4I_2$ or of CoI_2,CO is an essential part of the reaction, and accounts for the catalytic effect of I on the direct synthesis of the carbonyls from metals and CO. The binding of halogen by the (Cu or Ag) lining of the autoclave is also essential, and addition of finely-divided Cu or Ag increases the yield. F. J. G.

Metallic carbonyls. XLIII. Characterisation of the carbonyl hydrides of iron and cobalt and their metallic derivatives. W. Hieber and U. Teller (*Z. anorg. Chem.*, 1942, **249**, 58—64).—All attempts to prepare $Fe(CO)_4H_2$ or its metallic derivatives by high-pressure synthesis have failed. F. J. G.

Metallic carbonyls. XLII. High-pressure synthesis of heavy-metal derivatives of cobalt carbonyl hydride (mixed metallic carbonyls). W. Hieber and U. Teller (*Z. anorg. Chem.*, 1942, **249**, 43—57).—When Co or anhyd. Co halides are heated in CO at high pressure in presence of the appropriate metals the following *mixed carbonyls* are formed: $[Co(CO)_4]_2Zn$, $[Co(CO)_4]_2Cd$, $[Co(CO)_4]_3In$, $[Co(CO)_4]Tl$, $[Co(CO)_4]_3Tl$, $[Co(CO)_4]_2Sn$. They are typical carbonyls, volatile non-electrolytes, sol. in org. solvents. With aq. acids they afford $Co(CO)_4H$. F. J. G.

Cobaltous and chromic ethanolamine complexes. H. Brintzinger and B. Hesse (*Z. anorg. Chem.*, 1941, **248**, 345—350).—The following complex *compounds* containing $OH{\cdot}[CH_2]_2{\cdot}NH_2$ (HEtn) are described: $[Co(Etn)_2(HEtn)],3H_2O$, $[Co_2(Etn)(HEtn)_5](NO_3)_3$, $[Co_3(Etn)_4(HEtn_2)]I_2,6H_2O$, $[Cr(Etn)_2(HEtn)]Cl$. F. J. G.

Ethanolammonium and chloroethylammonium metallic chlorides. H. Brintzinger and B. Hesse (*Z. anorg. Chem.*, 1941, **248**, 351—356).—The following *compounds* are described: $(ClC_2H_4NH_3)_4[CoCl_6]$; $(ClC_2H_4NH_3)_2[CuCl_4],2H_2O$; $(OH{\cdot}C_2H_4NH_3)[CuCl_3],H_2O$; $(OH{\cdot}C_2H_4NH_3)_2[CuCl_4]$,aq.; $(ClC_2H_4NH_3)_2[NiCl_4],H_2O$; $(ClC_2H_4NH_3)_4[NiCl_6]$; $(ClC_2H_4NH_3)_2[CdCl_4]$; $(OH{\cdot}C_2H_4NH_3)_4[CdCl_6]$; $(ClC_2H_4NH_3)_3[FeCl_6]$; $(ClC_2H_4NH_3)_2[SnCl_6]$; $(OH{\cdot}C_2H_4NH_3)_3[SnCl_3]$; $Cl[Hg(Cl)NH_2C_2H_4{\cdot}OH]$; $Cl[Hg(Cl)NH_2C_2H_4Cl]$; $[Cr(NH_2C_2H_4Cl)_2]Cl_3,3(ClC_2H_4NH_3)Cl$. F. J. G.

Bivalent and tervalent rhodium compounds. I. Effect of reducing agents on tervalent rhodium salts, and properties of some rhodous salts. II. Hexacovalent complexes of rhodous halides with diphenylmethylarsine. F. P. Dwyer and R. S. Nyholm (*J. Proc. Roy. Soc. New South Wales*, 1941, **75**, 122—126, 127—129).—I. The effects of a no. of reducing agents on Rh^{III} solutions are described. The reaction $H_3PO_2 + 4RhCl_3 + 2H_2O = H_3PO_4 + 4RhCl_2 + 4HCl$ is autocatalytic. Impure *rhodous bromide*, *iodide*, and *sulphide* have been isolated.

II. The following complex Rh^{II} salts are described: $[RhCl_2,3AsPh_2Me]_2$, m.p. 171°; $[RhBr_2,3AsPh_2Me]$, m.p. 180°; $[RhI_2,3AsPh_2Me]_2$, m.p. 168° F. J. G.

X.—ANALYSIS.

Multiplication method for the separation of gas mixtures, particularly the application of increased gravitational fields. H. Martin and W. Kuhn (*Z. physikal. Chem.*, 1941, **A, 189**, 219—316).—A mathematical treatment of the separation of gaseous isotope mixtures. C. R. H.

Application of the temperature-dependence of adsorbability to the continuous fractionation or concentration of solutions. W. Kuhn and H. Martin (*Z. physikal. Chem.*, 1941, **A, 189**, 317—326).—The mathematical treatment previously developed (cf. preceding abstract) is applied to the separation of substances in solution by adsorption at two temp. A simple apparatus is described and its use illustrated by the separation of *l*- from *d*-mandelic acid by means of adsorption on wool. C. R. H.

New technique for adsorption studies. J. Coull, H. C. Engel, and J. Miller (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 459—462).—The method described comprises batch production of vapour–air mixtures of any desired composition, and the continuous analysis (thermal conductivity cell) of the mixture after passage through a bed of activated C. The method is especially useful in large-scale equipment for indicating extent of adsorption. Further applications are in the study of desorption of adsorbed vapours, and in adsorption of vapours from multicomponent systems. L. S. T.

Residue volume method of solubility determination. T. H. Vaughn and E. G. Nutting, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 454—456).—The method is based on measurements of the vols. of residues left by various mixtures of solvent and solute. It is useful for commercial mixtures, and for substances containing insol. impurities; it is not applicable to volatile solutes or solutes of $\rho <$ that of the solvent. L. S. T.

Theory of rapid methods of electro-analysis. A. Schleicher (*Z. Elektrochem.*, 1942, **48**, 173—177).—A general discussion with particular reference to the avoidance of time-lag errors. C. R. H.

Theory and practice of sedimentometric analysis. K. A. Putilov (*Issledov. Fiz.-Chim. tech. Suspensii*, 1933, 60—82).—A discussion. Ch. Abs. (*e*)

Reactivity of substituted thiocarbamides with inorganic ions. J. H. Yoe and L. G. Overholser (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 435—437).—The reactions of 78 inorg. ions with 60 substituted thiocarbamides and the sensitivities of the more sensitive reactions are reported. The reactions are similar to those observed with $CS(NH_2)_2$ (**I**), and although some are more sensitive for Bi, they offer no advantage over (**I**). Correlation between structure of the thiocarbamides and reactivity or non-reactivity of the ions, and between sensitivity and structure, was unsuccessful. L. S. T.

Potentiometric titrations. N. H. Furman (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 367—382).—A review with bibliography. L. S. T.

p_H Measurements in unbuffered solutions. Preparation of "p_H-pure" potassium and sodium chlorides. H. Lux (*Z. Elektrochem.*, 1942, **48**, 210—219).—A new Pt–H_2 electrode is applied to the measurement of the p_H of unbuffered solutions. The prep. of "p_H-pure" (*i.e.*, of unvariable p_H) H_2O, KCl, and NaCl is described. In moist air at 600° NaCl is considerably and KCl is slightly hydrolysed. C. R. H.

Theory of interionic reciprocal action and the practical measurement of p_H. G. Kortüm (*Z. Elektrochem.*, 1942, **48**, 145—166).—A review. C. R. H.

New procedure for detecting acidity. F. Feigl and P. E. Barbosa (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 519—521; cf. A., 1942, I, 276).—Pptd. Ag_2CrO_4 digested with aq. NH_3 or $(CH_2{\cdot}NH_2)_2$ (**I**) insufficient for complete dissolution gives an equilibrium solution of Ag ammine chromate or $Ag(CH_2{\cdot}NH_2)_2$ chromate that can be used to detect substances that consume H^+, NH_3, or (**I**), Ag_2CrO_4 being pptd. Application to the detection of amorphous SiO_2, quartz and sand (no reaction), certain natural silicates, WO_3, MoO_3, V_2O_5, Nb_2O_5, Ta_2O_5 (weak or no reaction), hydrolysed salts, metal ions that form stable ammine ions, and certain basic salts is described. The tests can be applied as drop reactions. L. S. T.

Titration of weak bases and strong acids in glacial acetic acid solution. K. Blumrich [with G. Bandel] (*Angew. Chem.*, 1941, **54**, 374—375).—Owing to its favourable dipole properties glacial AcOH is a suitable solvent for use in titrating weak bases, *e.g.*, org. amines, alkaloids, and C_5H_5N, with strong acids, Ac_2O being added to combine with any H_2O in the system. The standard acid used is $HClO_4$, the H_2O in which has been removed by the Ac_2O treatment. The end-point may be determined potentiometrically or by means of indicators, preferably α-naphtholbenzein. Medium strong bases may be determined in the presence of acid amides by using α-cresol-red as indicator, and alkali and NH_4 salts of fatty acids may be determined in the presence of fatty acid amides by potentiometric titration using a glass electrode or the tetrachlorobenzoquinone electrode as indicator. Many other applications of the method are described. A. R. P.

Determination of water of crystallisation of a salt from the crystallising solution. M. Nicloux (*Compt. rend.*, 1941, **213**, 758—761).—The H_2O of crystallisation of crystals formed in a dil. aq. EtOH solution of a salt is free from EtOH. A general determination on this basis is developed mathematically and confirmatory data for 7 salts are given. N. M. B.

Hydride method of determination of water in aquo-complex compounds. A. G. Elitzur (*J. Appl. Chem. Russ.*, 1941, **14**, 682—687).—Powdered CaH_2 is introduced into EtOH; when evolution of H_2 has ceased, the compound to be analysed is introduced, and the H_2 evolved is measured. The method indicates, *e.g.*, 5·2 H_2O in $Na_2S_2O_3,5H_2O$, 2·0 H_2O in $K_2HgCl_4,2H_2O$, etc., but only 4·01 H_2O in $CuSO_4,5H_2O$. The rate of evolution of H_2 can also be measured; its changes in the course of one dehydration show the presence of differently bound H_2O mols. J. J. B.

Effects of nitric and nitrous acids on Volhard chlorine determination. J. B. Bingley (*J. Proc. Austral. Chem. Inst.*, 1942, **9**, 108—111).—In Volhard titrations at ~20° no Cl′ is lost as Cl_2 or NOCl with $[HNO_3] \geqslant 4N$. In solutions boiled for 1 min. before titration perceptible loss of Cl′ occurs with $[HNO_3] > 1{\cdot}0N$. HNO_2 must be absent during the titration with thiocyanate. For determination of Cl in $CdCl_2$ containing free Cd the material is dissolved in cold 4N-HNO_3, and the Cl pptd. with $AgNO_3$; the solution is boiled to remove HNO_2, cooled, and titrated. A. J. E. W.

Determination of iodine in sea-water. B. Skopintzev (*Trans. Oceanogr. Inst. Moscow*, 1933, **3**, 105—118; cf. A., 1933, 477).—An improved method is described. Ch. Abs. (*e*)

Determination of iodate and other oxidising agents in presence of cupric salts. Use of the iodine monochloride end-point. E. H. Swift and T. S. Lee (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 466—468).—IO_3', MnO_4', BrO_3', and ClO_3' in presence of $Cu^{..}$ are determined by adding an excess of standard KI to the neutral solutions of the mixtures, acidifying, and titrating back to ICl end-point with standard oxidising solutions. IO_3'–$Cu^{..}$ mixtures can be determined by titrating standard KI with the mixture, both solutions having been first saturated with CO_2. The total IO_3' and $Cu^{..}$, or MnO_4' and $Cu^{..}$, or BrO_3' and $Cu^{..}$ can be determined iodometrically with aq. $Na_2S_2O_3$. The ClO_3'–I' reaction requires too high a [HCl] for the iodometric determination of $Cu^{..}$. L. S. T.

Spectrochemical determination of fluorine in phosphate rock. L. H. Ahrens (*J. S. African Chem. Inst.*, 1942, **25**, 18—32).—Optimum conditions for the spectrochemical detection of F include the presence of a large excess of Ca over that necessary for CaF_2 formation, and the admixture of the rock sample with powdered C so as to increase the speed of burning and reduce exposure time. A visual and a logarithmic sector method for the determination of F are described, a mean deviation of 12% over a range of 0·025—3·0% F being obtainable with the latter method. Interference is caused if $[SiO_2]$ is >65%, but it can be somewhat overcome by increasing the proportion of C. C. R. H.

Determination of fluorine. W. K. Ergen and R. E. Heath (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 399).—The PbClF can be filtered on a sintered glass disc of medium porosity. L. S. T.

Modification of the determination of fluoride in water supplies.—See B., 1942, III, 206.

[Cell for] titration of soluble sulphides. G. Spencer (*J.C.S.I.*, 1942, **61**, 132—133).—Commercial aq. Na_2S is titrated electrometrically with $AgNO_3$ using an end-point cell consisting of an Sb rod immersed in 0·1M-Na_2HPO_4, a Ag wire electrode, and a saturated K_2SO_4 salt bridge. SO_3'' (in small quantities), Cl', and S_2O_3'' cause only small error. A. A. E.

Determination of sulphur dioxide with iodine solution. K. Fridman and A. Potemkin (*Nauch. Zap. Sach. Prom.*, 1934, **11**, No. 11—12, 79—80).—Replacement of pyrogallol in the Orsat apparatus by 0·1N-I solution gives more accurate results. Ch. Abs. (*e*)

Determination of sulphates volumetrically by reduction. C. Cuschnir (*Rev. Fac. Cienc. Quim., La Plata*, 1941, **16**, 185—190)—The method of Auger and Gabillon (A., 1911, ii, 330) is the more satisfactory, the more sol. is the sulphate. F. R. G.

Stable sodium thiosulphate and starch solutions. J. Ehrlich (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 406).—0·05% NaOH + 0·1% NaOBz are used as preservatives for 0·1N-$Na_2S_2O_3$. The A.O.A.C. recipe for starch is modified by addition of NaOBz. L. S. T.

Determination of sulphur dioxide in gases and liquids, alone or in presence of sulphuric acid and nitrogen oxides.—See B., 1942, I, 379.

Colorimetric determination of low concentrations of sodium nitrate in sodium nitrite. W. Seaman, A. R. Norton, W. J. Mader, and J. J. Hugonet (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 420—422).—NO_2' interferes in the Wolf–Heymann (A., 1924, ii, 423) and Pesez (A., 1939, I, 624) methods owing to conversion of some NO_2' into NO_3'. NaN_3 is the most suitable reagent for removal of NO_2' without formation of NO_3'. Pesez' method is then applied for concns. up to 1% of $NaNO_2$ in $NaNO_3$. L. S. T.

Amperometric titrations. Determination of phosphate with uranyl acetate. I. M. Kolthoff and Cohn (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 412—418).—The polarographic waves of UO_2 acetate in weakly acid media are reproduced, and a procedure for the amperometric determination of PO_4''' at room temp. is given. With 0·01—0·0003M-PO_4''', accuracy is <1%. Alkaline-earth phosphates can be titrated by the procedure. $Ca^{..}$ in large amount, Fe, and org. anions interfere. Methods for eliminating interference are described. L. S. T.

Colorimetric micro-determination of arsenic. M. B. Jacobs and J. Nagler (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 442—444).—The A.O.A.C. Gutzeit method for generating AsH_3 is combined with the Mo-blue method for colour comparison, the AsH_3 being absorbed completely in one trapping tube containing aq. Br + aq. NaOH. 1·5 μg. of As can be determined accurately, and <1·5 μg. can be detected. L. S. T.

Determination of P_2O_5 by potentiometric titration. D. V. Vasiliev (*J. Appl. Chem. Russ.*, 1941, **14**, 689—694).—The phosphate solution ccontaining 1—5 mg. of P_2O_5 is mixed with 10 c.c. of Arrhenius solution (25 g. of NH_4 molybdate, 125 c.c. of conc. H_2SO_4, 875 c.c. of H_2O), diluted to 100 c.c., and titrated with aq. $SnCl_2$; the potential of a Pt wire immersed in the solution changes rapidly, and the rapid change ceases when 0·0658 m-equiv. of $SnCl_2$ is used per 1 mg. of P_2O_5. J. J. B.

Comparison of methods for determination of carbon monoxide.—See B., 1942, I, 378.

Photometric determination of potassium. I. W. Wander (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 471—472).—The ppt. of $K_2NaCo(NO_2)_6$ is used to reduce a known vol. of standard $K_2Cr_2O_7$ forming shades of yellow to green solutions, which are determined in a photo-electric colorimeter. L. S. T.

Polarographic determination of potassium, sodium, and lithium. I. Zlotowski and I. M. Kolthoff (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 473—477).—Two diffusion waves, one corresponding with $[Na^{\cdot}] + [K^{\cdot}]$, and the other with $[Li^{\cdot}]$, are obtained in 80% EtOH with NEt_4·OH (I) as supporting electrolyte. (I) is preferable to NMe_4·OH. $Na^{\cdot}$ and $K^{\cdot}$ can be determined polarographically with an accuracy within 3% in 50% EtOH with (I) concn. <50 times that of the alkali ions. L. S. T.

Micro-determination of sodium by the uranyl zinc acetate method and the titration of uranium with cadmium as the reductant. G. Chen (*J. Lab. Clin. Med.*, 1936, **21**, 1198—1202).—To 1 c.c. of the sample (containing 0·04—0·2 mg. of Na) 0·5 c.c. of abs. EtOH and 3 c.c. of freshly filtered UO_2 Zn acetate reagent (prep. described) are added. After 1—2 hr., the centrifuged ppt. is washed with glacial AcOH saturated with the triple salt and then with Et_2O. The ppt., dissolved in N-H_2SO_4, is reduced with Cd and the U^{IV} titrated cold with 0·02 N-$KMnO_4$. Ch. Abs. (*e*)

Barium sulphide. Products of its decomposition, analytical methods, and solubility. I. Methods of determination and decomposition products. C. Chorower (*Anal. Fis. Quim.*, 1941, **37**, 324—349).—OH' is titrated using phenolphthalein, S_2O_3'' titrated iodometrically, S'' is determined by Feld's method (A., 1898, ii, 246). Owing to the instability of BaS a fresh portion must be weighed for each analysis. F. R. G.

Thermionic electrometer and the oxinimetric determination of magnesium. A. Carabelli (*Rev. Fac. Cienc. Quim., La Plata*, 1941, **16**, 199—207).—Mg is determined satisfactorily by pptn. as 8-hydroxyquinoline derivative, and subsequent electrometric titration. F. R. G.

Determination of magnesia in water by means of potassium palmitate.—See B., 1942, III, 206.

Rapid determination of lead and zinc in residues from treatment of ores.—See B., 1942, I, 387.

Formation of water-insoluble complexes of α-naphthylamine with metallic thiocyanates and their analytical applications. F. Buscaróns and R. Alloza (*Anal. Fis. Quim.*, 1941, **37**, 350—355).—Aq. solutions of $Hg^{..}$ and $Cu^{..}$ with KCNS and a few drops of 4% α-$C_{10}H_7$·NH_2 in EtOH give yellow and violet ppts. respectively. 1 in 27,000 of $Hg^{..}$ and 1 in 300,000 of $Cu^{..}$ can be detected. The Hg complex is $Hg(C_{10}H_7{\cdot}NH_2)_2(CNS)_2$. The reactions are not masked by $Fe^{...}$ and analogous ppts. are not formed by other metals. β-$C_{10}H_7$·NH_2 does not form an analogous complex with $Cu^{..}$. F. R. G.

Colorimetric determination of rhenium by a catalytic reaction. N. S. Poluektov (*J. Appl. Chem. Russ.*, 1941, **14**, 695—702).—In presence of ReO_4' $SnCl_2$ reduces Na_2TeO_4 to Te, which can be determined from the extinction E of its solutions. For ~1 hr. after mixing the solutions $E \propto$ time, and the coeff. of proportionality, which depends also on $[SnCl_2]$ etc., $\propto [Na_2TeO_4]$ and $[ReO_4']$. Hence, $[ReO_4']$ can be found from E after a definite time, or, better, from E of the unknown solution, E of this solution + 15 × 10^{-8} g. Re, and E of this solution + 1·5 × 10^{-8} g. Re. The reagent consists of 5 c.c. of 0·5% Na_2TeO_4, 2 c.c. of 30% tartaric acid, 1·5 c.c. of 0·5% gelatin, and 1·5 c.c. of conc. $SnCl_2$. J. J. B.

***o*-Nitrosophenol as a new reagent in colorimetric analysis. Determination of bivalent iron.** G. Cronheim and W. Wink (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 447—448).—The solution containing $Fe^{..}$ is shaken with *o*-NO·C_6H_4·OH in light petroleum (I) at p_H 5·1—5·3, and the green, aq. layer used for the colorimetric determination. PO_4''', C_2O_4'', etc. must be absent. $Fe^{...}$, $Co^{..}$, and $Pd^{..}$ do not interfere as their compounds are sol. in (I). Suitable colour filters eliminate interference by the red, H_2O-sol. complexes of Cu, Ni, Hg, and Zn. 0·5 μg. of $Fe^{..}$ in 50 ml. can be determined. L. S. T.

***o*-Nitrosophenol as a new reagent in colorimetric analysis. Determination of cobalt.** G. Cronheim (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 445—447).—The method described is based on the reaction between $Co^{..}$ and *o*-NO·C_6H_4·OH, and the extraction of the greyish-brown colour with light petroleum at p_H 4·0 (citrate–citric acid buffer). 5 μg. of $Co^{..}$ in 50 ml. can be determined with an error >1%. Interference from $Fe^{...}$ is eliminated by using a citrate buffer, and from $Pd^{..}$ by using coloured filters. L. S. T.

Qualitative reagents for cations. Reagents for nickel cations. P. Wenger and R. Duckert [with M. L. Busset] (*Helv. Chim. Acta*, 1941, **24**, 889—899).—A crit. review of qual. tests, chiefly drop reactions, for Ni, supplementing the Report of the International Commission on new analytical reactions and reagents. A. J. E. W.

Conductometric determination of conversion of chromates into dichromates. G. N. Kadhe and N. L. Phalnikar (*J. Univ. Bombay*, 1942, **10**, **A**, *Part* 5, 35—38).—The method is accurate to ~0·5%. D. F. R.

Fractional detection of molybdates. I. M. Korenman and N. P. Tardov (*J. Appl. Chem. Russ.*, 1941, **14**, 666—668).—5 c.c. of solution

containing molybdates and heavy metals are mixed in a short burette with 1 c.c. of 2N-HCl, 1 c.c. of Et_2O, and K xanthate. The aq. layer is run out and 2 c.c. of 2N-NaOH are introduced with shaking. The alkaline layer is acidified; it is pink or violet in presence of Mo^{VI}. Pptn. of heavy metals by NaOH allows Mo to be detected if the original solution contained, *e.g.*, 1500 Fe for 1 Mo. J. J. B.

Chemical analysis of black and ruby sands. V. Zemel (*Sovet. Zolotoprom.*, 1936, No. 3, 50—51).—A method is given for the determination, in one sample, of W, V, and Mo, and for the detection of Sn, Ta, Nb, Th, Zr, and rare earths. CH. ABS. (*e*)

Determination of antimony by means of titanous sulphate. H. Holness and G. Cornish (*Analyst*, 1942, **67**, 221—223).—Sb^V in HCl solution is determined by titration with 0·4% $Ti_2(SO_4)_3$ in CO_2 at >60° with a final acid concn. 4—8N. Indigo-carmine, neutral-red, phenosafranine, safranine, and brilliant-cresyl-blue are suitable indicators when added 1 ml. before the end of the titration. Excess of Br used to preoxidise the Sb must be completely removed by boiling for 10 min. and reducing the vol. to half. Excessive boiling produces losses by reduction. The end-point of the titration must be slowly approached. Cu, As, and Fe, but not Pb and Sn, interfere. S. B.

Ferrocyanide method for separation of hafnium from zirconium. W. C. Schumb and F. K. Pittman (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 512—515).—Factors affecting the separation of Zr and Hf by Prandtl's method (A., 1933, 38) have been investigated and their optimum conditions determined. Modifications improve the separation so that in 4 successive ferrocyanide pptns. the HfO_2 content of an oxide mixture was enriched as follows: 12—20, 20—36, 36—62, and 62—80%. Accuracy and reproducibility in the Claasen method (A., 1939, I, 536) for the analysis of Zr–Hf mixtures are satisfactory. Hf-rich Zr can be extracted readily from Bedford, N.Y., cyrtolite by means of conc. H_2SO_4. L. S. T.

Determination of small amounts of gold with stannous chloride. C. G. Fink and G. L. Putnam (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 468—470).—Because of neglect of the factor of acid concn., former modifications of the $SnCl_2$ test for Au are untrustworthy. The factors affecting this test have been investigated. The colour obtained is primarily a function of acid concn. and not of [Au]. With low acidities, a yellow colloidal form is produced; with high acidities, the form is purple. Treatment of the yellow solutions with HCl to raise the acid concn. to 2—6N. promotes the change to purple. The low-acid $SnCl_2$ test is more reproducible, sensitive, and trustworthy than the high-acid test, and under conditions of controlled acidity is semi-quant. L. S. T.

Determination of palladium with β-furfuraldoxime. J. R. Hayes and G. C. Chandlee (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 491—493).—$Pd(C_4H_3O{\cdot}CH{:}N{\cdot}OH)_2Cl_2$ is pptd. in presence of HCl by means of β-furfuraldoxime (**I**), dried at 110°, and weighed. Pt, Ru, Rh, Ir, and numerous common anions and cations do not interfere. $Au^{...}$ is reduced partly to metal, $Ce^{....}$ gives a yellow ppt., and $Fe^{..}$ a red colour with (**I**). $Ag^{.}$, $Hg^{..}$, and $Pb^{..}$ must be absent. The method has advantages over that using dimethylglyoxime. L. S. T.

Fractional flotation detection of palladium. I. M. Korenman and S. I. Kaplanski (*J. Appl. Chem. Russ.*, 1941, **14**, 669—670).—The Pd solution is acidified to p_H 3, mixed with saturated dimethylglyoxime in EtOH, and shaken with Et_2O. A yellow ppt. is formed at the phase boundary. The presence of Et_2O enables Pd to be detected in presence of much Co, Cr, Pb, etc. J. J. B.

XI.—APPARATUS ETC.

Temperature correction methods in calorimetry. R. S. Jessup (*J. Appl. Physics*, 1942, **13**, 128—137).—Errors attributed by King and Grover (A., 1942, I, 73) to measurements in bomb calorimeters or by the method of mixtures are eliminated by proper experimental calibration. O. D. S.

Significance of low-temperature research. F. Simon (*J. Inst. Metals*, 1941, **67**, 325—332).—A lecture describing the principles on which modern methods of reaching temp. approaching 0° K. are based, and some of the phenomenon observed at these low temp. A. R. P.

Testing and accurate use of Abbe-type refractometers. L. W. Tilton (*J. Opt. Soc. Amer.*, 1942, **32**, 371—381). N. M. B.

Refractive index measurements at and above the m.p. of solids. H. A. Frediani (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 439—441).—Apparatus for the simultaneous determination of m.p. up to 200° (±1—2°) and n between 1·300 and 1·900 (±0·002) is described. Dispersions can be estimated, and all the data obtained used for the identification of org. solids. L. S. T.

Photometric instruments used in *X*-ray diffraction and spectrographic methods of analysis. J. W. Ballard, H. I. Oshry, and H. H. Schrenk (*U.S. Bur. Mines*, 1942, *Rept. Invest.* 3638, 13 pp.).—A recording microphotometer and three non-recording densitometers for measuring lines on *X*-ray films or spectrographic plates are described. F. J. G.

Microphotometer. R. Fürth (*Nature*, 1942, **149**, 730).—The instrument consists of a receiver (source, slit, microscope objective, plate oscillating normally to the beam, and Cs photo-electric cell) and a recorder (cathode-ray oscillograph with a two-stage linear amplifier), electrically connected. The magnification can be quickly changed, and the blackening curve can be obtained over the whole length of the plate. A. A. E.

Light filters for the region from 1 to 5 μ. M. P. Buchman (*J. Tech. Phys. U.S.S.R.*, 1935, **5**, 1097—1102).—Transparency curves are given for a large no. of filters. CH. ABS. (*e*)

Application of sylvite in optics. A. M. Kublitzki (*J. Tech. Phys. U.S.S.R.*, 1935, **5**, 1475—1476)—Optical data for KCl are recorded and discussed. CH. ABS. (*e*)

Spectrocomparator.—See A., 1942, III, 724.

Photoelectric colorimeter; its application in the measurement of the concentration of coloured substances in solution. F. M. Turrell and L. Waldbauer (*Proc. Iowa Acad. Sci.*, 1935, **42**, 63—66).—The apparatus is described. Data are given for aq. $KMnO_4$, $NiSO_4.6H_2O$, and chlorophyll-*a* + *b*. CH. ABS. (*e*)

Use of economical electrodes in practical electrochemistry. L. S. V. de Bollini (*Rev. Fac. Cienc. Quím., La Plata*, 1941, **16**, 159—170).—Employment of stainless steel electrodes and gilded micro-electrodes is discussed, the latter giving satisfactory results in the electrolytic determination of Au in pharmaceutical preps. F. R. G.

Principles of microelectrophoresis cells.—See B., 1942, I, 362.

Electronic relays. S. Redfern (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 502).—A correction (A., 1942, **I**, 186). L' S. T.

Device for demonstrating electronic transfer in redox reactions. L. F. LeRoy (*J. Chem. Educ.*, 1942, **19**, 236). L. S. T.

Electric hygrometer. R. N. Evans and J. E. Davenport (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 507—510).—Factors relating to the mechanism by which the hygrometer functions have been investigated. The resistance of the hygrometer, if without hysteresis, follows H_2O v.p. regularly except at H_2O v.p. < that of the saturated solution of the salt used as the electrolyte. L. S. T.

Silver–magnesium alloy as a secondary electron-emitting material. V. K. Zworykin, J. E. Ruedy, and E. W. Pike (*J. Appl. Physics*, 1941, **12**, 696—698).—A Ag–Mg alloy (1—15% Mg) is suitable for a secondary electron-emitting electrode. The methods of production and activation of the alloy are described. A. J. M.

Ionisation measurements on fast neutrons. K. G. Zimmer (*Physikal. Z.*, 1941, **42**, 360—365).—A spherical, air-filled ionisation chamber constructed from "Aerion," a conducting plastic containing H, is described; it is suitable for measurement of the ionisation produced by fast neutrons in H-containing material, *e.g.*, biological tissues. The theory of the method and test data are given. A. J. E. W.

Ion source with a mass chromator for neutron generators. M. von Ardenne (*Physikal. Z.*, 1942, **43**, 91—101).—Constructional details are given. A. J. M.

Transportable cloud-chamber for demonstration purposes. P. Kunze (*Physikal. Z.*, 1941, **42**, 405—409). A. J. E. W.

High-voltage apparatus for atomic disintegration experiments. J. D. Craggs (*Proc. Physical Soc.*, 1942, **54**, 439—456).—The construction and characteristics of an apparatus giving 100—200-μa. beam currents at 600 kv. are described, and some experiments with nuclear γ-rays are briefly reported. N. M. B.

Electrometer for measurement of voltage on small ionisation chambers. F. T. Farmer (*Proc. Physical Soc.*, 1942, **54**, 435—438).—For use with small-capacity Sievert-type chambers, the accurate and convenient instrument described embodies two electrometer valves functioning together in the manner of a "cathode follower," and gives direct dial readings. N. M. B.

Portable mass spectrometer. J. A. Hipple, jun. (*Nature*, 1942, **150**, 111—112).—The instrument (illustrated) is suitable for routine gas analysis and is conveniently dismantled for transportation. A. A. E.

Surface studies with the electron microscope. V. K. Zworykin and E. G. Ramberg (*J. Appl. Physics*, 1941, **12**, 692—695).—Methods of observing surfaces of compact bodies with the electron microscope are considered, and the method by which a replica of the surface is made with a material sufficiently thin to allow transmission of 50-ke.v. electrons is preferred. A method of making the replica without destroying the original surface is described, and two alternative methods, of more limited application, are given. A. J. M.

Resolution of very fine single particles, especially molecules, by the universal electron microscope. M. von Ardenne (*Z. physikal. Chem.*, 1940, **A, 187**, 1—12).—Metallic particles of diameter ≮10—15 A. and spherical org. particles of diameter ≮~40 A. are resolved. Electron-optical conditions for max. contrast are discussed. L. J. J.

Electronic timer. I. C. Bechtold (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 429—430).—The apparatus described can operate mechanical devices automatically at predetermined time intervals. L. S. T.

Irregularities in the behaviour of certain photo-electric cells. D. Cavassilas (*Compt. rend.*, 1941, **213**, 346—348).—Certain Cs-on-Ag_2O vac. photo-cells with central anode show instability in that with const. illumination and accelerating potential (V) the current varies during measurements. With increasing V the instability sets in at a definite val. V_1, whilst with decreasing V it sets in again at a lower potential V_2. Generally $V_1 - V_2 = 5$—15 v. and over this range the current can have two relatively stable vals. for any val. of V. Measurements with a magnetic field applied to the cells suggest that the anomalies are attributable to the accumulation of electrons on the inside of the wall or window. J. W. S.

Testing of glass volumetric apparatus. E. L. Peffer and G. C. Mulligan (*U.S. Bur. Stand.*, 1942, *Circ.* C434, 27 pp.).—Specifications, tolerances, and methods of testing for apparatus of precision grade are described. L. S. T.

Micro-gas analyser. P. F. Scholander (*Rev. Sci. Instr.*, 1942, **13**, 264—266).—With the apparatus described 10 cu. mm. of respiratory gas can be analysed for CO_2, O_2, and N_2 with an accuracy of ~0·1% of the total sample. A. A. E.

[Low-temperature] rectifying column. E. O. Ramler and J. H. Simons (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 430). L. S. T.

Adapters for collection of distillation fractions under vacuum. J. W. Patterson and R. W. Van Dolah (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 511—512).—Two models are described. L. S. T.

Apparatus for determining distillation ranges at reduced pressures. C. E. Watts, J. A. Riddick, and F. Shea (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 506—507). L. S. T.

Semiautomatic fractionation. Rapid analytical method. B. Ferguson, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 493—496).—A still-head with const. take-off rate for a laboratory column is described. The still is semi-automatic in operation. L. S. T.

Improved Soxhlet extractor. M. H. Neustadt (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 431). L. S. T.

Apparatus for semi-micro-filtration. J. Cornog and F. O. Krause (*J. Chem. Educ.*, 1942, **19**, 217). L. S. T.

Absorption measurements with biological liquids in the wave-length range 50—100 cm.—See A., 1942, III, 774.

[Apparatus for] mechanical polishing with a film of abrasive. F. L. Stillwell (*Econ. Geol.*, 1942, **37**, 76—78). L. S. T.

Dry polishing of opaque minerals. H. J. Fraser and R. von Huene (*Amer. Min.*, 1942, **27**, 261—280). L. S. T.

Sodium[-wire] press. W. C. Beard, jun. (*J. Chem. Educ.*, 1942, **19**, 214). L. S. T.

Glass valve pressure regulator. M. J. Caldwell and H. N. Barham (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 485). L. S. T.

Trap to prevent backflow from suction pumps. A. E. Meyer (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 505). L. S. T.

Slide rule for making potentiometric and glass electrode p_H calculations. L. Kratz (*Z. Elektrochem.*, 1942, **48**, 132—134). C. R. H.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Lecture experiment on the synthesis and combustion of ammonia. F. W. Fromm (*J. Chem. Educ.*, 1942, **19**, 230). L. S. T.

Phase models for ternary systems. P. P. Sutton (*J. Chem. Educ.*, 1942, **19**, 238). L. S. T.

History of viscometry. F. Höppler (*Kolloid-Z.*, 1942, **98**, 1—5).—Amenemhet (B.C. 1565) probably made the first recorded attempt to allow for the temp. variation of η in the construction of flow clocks. F. L. U.

(Julius) Robert Mayer, 1814—1878. R. E. Oesper (*J. Chem. Educ.*, 1942, **19**, 134). L. S. T.

XIII.—GEOCHEMISTRY.

Geological applications of nuclear physics. C. Goodman (*J. Appl. Physics*, 1942, **13**, 276—289).—The applications of nuclear physics to geochronology, geophysics, and geochemistry are reviewed and discussed, and future applications are outlined. A. J. M.

Occurrence and significance of nitrite in the sea. N. W. Rakestraw (*Biol. Bull.*, 1936, **71**, 133—167).—Comprehensive data for [NO_2'] are given, showing the effect of location, depth, temp., d, NH_3, NO_3', PO_4''', and seasonal changes. The [NO_2'] varies normally from 0 to 0·35 μg.-atom per l. Ch. Abs. (*e*)

Iodine content of White Sea water. A. Skopintzev and L. Michailovskaja (*Trans. Oceanogr. Inst. Moscow*, 1933, **3**, 79—86).—The I content is < Reith's average val. (cf. A., 1930, 315) for northern seas, owing to the lower salt content of White Sea H_2O. Ch. Abs. (*e*)

Heavy-water content of deep-sea water. F. P. Worley (*Trans. Proc. Roy. Soc. New Zealand*, 1936, **66**, 97—98).—Samples from depths of 4000, 4500, and 5000 m. were identical in d with tap-H_2O. Ch. Abs. (*e*)

Pattern of ground-water flow and solution. R. Rhoades and M. N. Sinacori (*J. Geol.*, 1941, **49**, 785—794). L. S. T.

Sediments of the Gulf of California. R. Revelle (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1929). L. S. T.

Direction of flow of mineralising solutions. W. H. Newhouse (*Econ. Geol.*, 1941, **36**, 612—629).—Experiments with NH_4Cl, KCl, and K alum, and investigations on minerals and ores, show that in a moving solution a crystal grows most rapidly on the side that faces the direction of flow, and direction of solution movement can often be determined by examining growth zones in crystals, crystal distortion, lineages, and preferential corrosion or dissolution of a mineral or mineral aggregate. L. S. T.

Critical evaluation of the present status of the helium method of the age determination of rocks. W. J. Mead, R. D. Evans, and C. Goodman (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1921). L. S. T.

Binding of water in zeolites. O. Glemser (*Naturwiss.*, 1941, **29**, 769).—The binding of H_2O mols. in zeolites varies from one to another. In some zeolites some of the H_2O is free to move; in others it is completely fixed. A. J. M.

Classification of the native elements, sulphides, and sulpho-salts. H. Berman (*Amer. Min.*, 1940, **25**, 204). L. S. T.

Reduction of hardness and facilitation of mechanical dispersion under the influence of adsorptive layers of surface-active materials. N. A. Kalinovskaja and P. A. Rebinder (*Issledov. Fiz.-Chim. tech. Suspensii*, 1933, 144—161).—The hardness of minerals and rocks to scratching is sharply reduced by the formation of adsorption layers. The facilitation of mechanical dispersion by adsorption layers is affected by the influence of such layers on external friction. The applicability of Traube's rule to the reduction in hardness was established. Ch. Abs. (*e*)

Tables for the identification of ore minerals by *X*-ray powder patterns. G. A. Harcourt (*Amer. Min.*, 1942, **27**, 63—113).—Powder diffraction data for 169 ore minerals are recorded. An index of powder patterns is given. L. S. T.

Minor elements in diamond. F. G. Chesley (*Amer. Min.*, 1942, **27**, 20—36).—Emission spectra (2800—4600 A.) of 33 diamonds from Africa and S. America are recorded, and discussed in relation to locality, form, colour, *X*-ray pattern, and fluorescence. Of the 30 elements sought, Al, Si, Ca, Mg, Cu, Fe, Ba, Sr, Na, Ag, Ti, Cr, and Pb were found. Al, Si, and Ca were detected in every diamond; Al and Si showed sympathetic variation. Ultra-violet absorption spectra for six of the diamonds showed that 5 were of type I, and 1 was of type II. Diamonds of cubic, but not octahedral, habit contained Ag and Ti. Fe and Ti tend to be present in coloured specimens. 17 of the diamonds showed fluorescence, but this could not be correlated with minor element content. L. S. T.

Origin of the Mansfield copper deposits. C. H. White (*Econ. Geol.*, 1942, **37**, 64—68). L. S. T.

Copper deposit of the Duckdown type near the Coeur d'Alene district, Idaho. A. L. Anderson (*Econ. Geol.*, 1941, **36**, 641—657).—Mineralogy and origin are described. L. S. T.

Native copper deposit near Jefferson City, Montana. J. D. Forrester (*Econ. Geol.*, 1942, **37**, 126—135).—Native Cu occurs as a cement placer material. Laboratory and field studies show that the Cu is derived from oxidation of narrow epigenetic veins, and is carried downward as aq. $CuSO_4$ until it reaches a reducing environment of peat muck, bog-Fe oxide, and alluvial gravels. L. S. T.

Carbonate-apatites; francolite from the Richtersveld, S. Africa. J. E. de Villiers (*Amer. J. Sci.*, 1942, **240**, 443—447).—A chemical analysis [C. J. Liebenberg] and optical and physical properties are recorded. The F content (5·60%) is unusually high, and approx. 1 P per unit cell is replaced by C. The composition supports the Gruner–McConnell theory (A., 1938, I, 52) of the structure of carbonate-apatites. L. S. T.

Occurrence of scheelite near Agargaon, Nagpur district. K. K. Sen Gupta (*Quart. J. Geol. Soc. India*, 1941, **13**, 179—182).—The scheelite occurs as a band in wolfram-bearing quartz veins intercalated in schists with almost vertical dip. A. R. Pe.

Occurrence of pargasite in Mysore. P. R. J. Naidu (*Current Sci.*, 1942, **11**, 192—193).—Chemical analysis of blue amphiboles approximates to that of pargasite rather than hornblende. E. R. R.

Steenstrupin, a silicate of the apatite formula-type. H. Strunz (*Naturwiss.*, 1942, **30**, 65).—The formula of steenstrupin has been corr. to $(X)_5[(OH,F)](SiO_4)_3]$, with 4 units in the elementary

cell. The new formula is analogous with that of apatite, $Ca_5[F](PO_4)_3$. A. J. M.

Chemical changes during regional metamorphism in the Presidential Range of New Hampshire. M. P. Billings (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1900).—Addition of K_2O is shown by the extensive replacement of andalusite and sillimanite by muscovite and sericite. Part of the formation has been converted into a gneiss by the introduction of Na_2O and CaO. L. S. T.

Griphite, a hydrophosphate garnetoid. D. McConnell (*Amer. Min.*, 1942, **27**, 452—461).—Griphite, hardness 5½, ρ 3·40, n 1·64—1·66, is cubic (a_0 12·26 A.) and is similar in structure to the garnets, but has probably a lower symmetry. The structural formula is $8[(Na,Al,Ca,Fe)_3Mn_2(PO_4)_{2\cdot5}(OH)_2]$. A chemical analysis is recorded. The properties of garnetoids, substances other than simple silicates having a structure similar to garnets, are compared. Schorlomite, a_0 12·09 A., is classified as a true garnet rather than as a garnetoid. Uvarovite has a_0 11·97 A. L. S. T.

Hetaerolite, hydrohetaerolite, coronadite, and hollandite. C. Frondel and E. W. Heinrich (*Amer. Min.*, 1942, **27**, 48—56).—Hetaerolite (**I**), $ZnMn_2O_4$, is isostructural with hausmannite, $MnMn_2O_4$. Weissenberg X-ray study gave a_0 5·74, c_0 9·15 A., $a_0:c_0 = 1:1{\cdot}594$, $a:c = 1:1{\cdot}5952$ (morph.); cell content $Zn_4Mn_8O_{16}$. Hydrohetaerolite (**II**) [(**I**) from Leadville] differs from (**I**) in its fibrous character, cell dimensions (a_0 5·71, c_0 9·04 A.), and in containing some SiO_2 and H_2O. The mineral status of (**II**) is uncertain. Coronadite, $MnPbMn_6O_{14}$, is a valid species, and is isostructural with hollandite (**III**), which appears to be $MnBaMn_6O_{14}$. Psilomelane (17% BaO) and (**III**) are distinct species. L. S. T.

[Ore] zoning in the Bolivian tin belt. F. Ahlfeld (*Econ. Geol.*, 1941, **36**, 569—588).—Three groups of deposits are distinguished. Group A includes the Sb deposits and minor deposits containing Sb, Zn, Pb, Ag, Fe, Cu, Ni, Co, Se, W, Au, and Hg most of which are epithermal and show little zonal distribution of minerals. Group B contains most of the W deposits, many of the prominent Sn deposits, and deposits containing Sn, W, Mo, Bi, As, Cu, Fe, Zn, Pb, Ag, Au, Sb, Li, Ti, Ni, Co, Te, and Hg. Zoning of minerals is well shown in this group. Group C contains some of the large Sn and Ag deposits, and the same elements as those of group B, with the exception of Ti, Li, Te, Mo, and Hg. L. S. T.

Distribution of minor chemical elements in Tertiary dyke rocks of the Front Range, Colorado. J. M. Bray (*Amer. Min.*, 1942, **27**, 425—439).—Relationships shown by quant. and qual. spectrographic analysis of the minor elements in these rocks (mainly monzonites and latites) and their constituent minerals are discussed. Analyses of plagioclase, biotite, groundmass, and magnetic concentrates show systematic differences in the no. and quantity of minor elements in each mineral. Geochemical affinities, such as the tendencies of Ba to substitute for K, Sr for Ca, V and Cr for Fe, Zn for Fe^{II}, and Sc for Fe^{II} and Mg, are revealed. Geochemical pairs, or pairs of minor elements distributed in the same manner, *e.g.*, V and Cr, Ni and Co, are apparent. The ratios between similar minor constituents, such as SrO : BaO and $V_2O_5 : Cr_2O_3$, show systematic differences from mineral to mineral, and from district to district. Important index elements are Pb, Ni, Co, Sc, Cr, V, La, Y, Ce, Nd, Ti, and Mn; their use permits a grouping or correlation of rock types and a rough regional classification. Each mineral species is characterised by particular minor constituents. L. S. T.

Breccia at Sudbury, Ontario. H. W. Fairburn and G. M. Robson (*J. Geol.*, 1942, **50**, 1—33).—Chemical analyses of and changes in the breccia are described. Origin, and relation to the nickeliferous sulphides, are discussed. L. S. T.

Malignites of Poohbah Lake, Ontario. C. C. Allen (*J. Geol.*, 1942, **50**, 134—151).—Two new chemical analyses are recorded and discussed. L. S. T.

Unit cell and space-group of orpiment. M. J. Buerger (*Amer. Min.*, 1942, **27**, 301—304).—X-Ray Weissenberg study shows that orpiment is monoclinic and not orthorhombic; a_0 11·47, b_0 9·57, c_0 4·24 A., β 90° 27′; space-group $P2_1/n$ (C_{2h}^5), unit cell $4As_2S_3$. L. S. T.

Bixbyite and pseudobrookite from the tin-bearing rhyolite of the Black Range, New Mexico. C. Friess, jun., W. T. Schaller, and J. J. Glass (*Amer. Min.*, 1942, **27**, 305—322).—A review of chemical analyses and a new analysis of material from this locality confirms the formula $(Mn^{III},Fe^{III})_2O_3$ for bixbyite (**I**). Other occurrences of (**I**) and pseudobrookite, $Fe_2O_3.TiO_2$, are reviewed. L. S. T.

Conditions for the formation of paragonite. J. W. Gruner (*Amer. Min.*, 1942, **27**, 131—134).—Paragonite (**I**) mica has been synthesised by heating Al_2O_3,nH_2O, SiO_2,nH_2O, and NaCl in presence of HCl, in a Au-lined bomb at 400°. The spacing of the unit cell normal to (001) is 19·33±0·02 A., compared with 20·0 A. in muscovite; b_0 is 8·90±0·02 A. compared with 9·00±0·02 A. The scarcity of (**I**) may be due to the smallness of Na^+ which does not allow them to fit into the K positions of the micas. L. S. T.

Dolomite pseudomorphous after crystals of aragonite. D. A. Andrews and W. T. Schaller (*Amer. Min.*, 1942, **27**, 135—140).—Such dolomite occurs in abundance in Wyoming. A chemical analysis is given. L. S. T.

Oruro silver–tin district, Bolivia. D. F. Campbell (*Econ. Geol.*, 1942, **37**, 87—115).—Mineralisation occurred in two stages, an early quartz–pyrite–cassiterite stage and a late Ag sulpho-salt stage. Ore deposition took place at relatively high temp. at a depth of 1000—2000 ft. L. S. T.

Löllingite from the Philippine Islands. J. Murdoch and D. L. Gardner (*Econ. Geol.*, 1942, **37**, 69—75).—Löllingite, As 67·64, Sb 0·11, S 1·08, Fe 29·31, and Cu 1·86% [F. A. Gonyer], spectroscopic traces of Pb, Co, and Mn, forms the principal metallic gangue mineral of the ore in the San Mauricio mine. L. S. T.

Geology and ore deposits of the Dillon Nickel Prospect, S.W. Montana. H. Sinkler (*Econ. Geol.*, 1942, **37**, 136—152).—The complex (0·15—1·25% Ni) is composed of saxonite, periodotite, nickeliferous serpentine, and related rocks. The chief Ni-bearing mineral is annabergite (29—34% Ni). No sulphides other than a small amount of pyrrhotite and pentlandite were found. There is a large amount of low-grade Ni silicate ore. Chemical and spectrographic analyses are recorded. L. S. T.

Lepidolite system. A. N. Winchell (*Amer. Min.*, 1942, **27**, 114—130; cf. A., 1939, I, 109; 1940, I, 240).—Chemical analyses and optical properties of numerous lithia micas are discussed in further correlation (A., 1933, 928) of chemical composition and optical properties. L. S. T.

Minerals from S. California. IH. J. Murdoch and R. W. Webb (*Amer. Min.*, 1942, **27**, 323—330; cf. A., 1941, I, 352).—Linarite and associated minerals from Darwin, Inyo Co.; orthoclase phenocrysts from Cinco; hemimorphite crystals from Lead Hill mine, Barstow; corundum and associated minerals near Banning, San Jacinto mountains; and zeolites and associated minerals from Red Rock Canyon, are described. L. S. T.

Giant andalusite in pegmatite from Riverside Co., California. R. W. Webb (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1961—1962). L. S. T.

Nepheline-syenite pegmatites, Rocky Boy Stock, Bearpaw Mountains, Montana. W. T. Pecora (*Amer. Min.*, 1942, **27**, 397—424).—Chemical analyses of sanidine, potash nepheline, lamprophyllite, and fibrous aegirite, and physical properties of these and associated minerals, are recorded. The distribution and utilisation of rare constituents in the formation of the minerals in the pegmatites are discussed. L. S. T.

Variation in the properties of pyrite. F. G. Smith (*Amer. Min.*, 1942, **27**, 1—19).—37 crystals of pyrite representing a wide range of habit, locality, and mode of occurrence varied as follows: composition $FeS_{1\cdot91}$—$FeS_{2\cdot01}$; ρ 5·000—5·025; sp. resistance at 20°, 0·014—256 Ω. per cm.^{3}; temp. coeff. of resistance −214 through zero to +26·5; thermo-electric potential against Cu, strongly negative through zero to strongly positive. The variations are explained mainly in terms of S deficiency, giving Fe in S positions, and secondary crystal or lineage structure giving interruptions of the crystal structure and reducing conductivity. L. S. T.

Micrography and metallurgy of the great Nordenskiöld [metallic] iron boulder from Ovifak [Greenland]. H. Löfquist and C. Benedicks (*Jernkont. Ann.*, 1940, **124**, 633—685).—The boulder (25 tons) is essentially cast Fe (C 3·48—3·92%, Ni 1·76—1·87%, S 1·04—1·14%, N 0·0—0·2%; Mn absent), composed of pearlite and cementite (**I**) with troilite (**II**) and oxide-pearlite. Crystals of (**I**) are abundant and have been stabilised by (**II**). The block is extensively permeated with cracks (0·01—0·1 mm. diameter), especially in the interior; these have probably been caused by internal strains set up during cooling. The micrographic metallurgical examination is described in detail; P occurs as schreibersite, and pentlandite (**III**), bravoite (**IV**), göthite, and hisingerite are present. A new fine-grained aggregate of (**III**) and (**IV**) is described as nifesite. The boulder is of terrestrial origin, probably formed by reduction of FeS (which occurs in similar-sized blocks in the neighboured) with C at >1000°, by trapping of the boulder in molten graphitic basalt. A regulus of similar structure and composition was prepared by melting FeS in a graphite crucible at 1500°. M. H. M. A.

Pre-Cambrian iron mineralisation in S.W. Missouri. C. Tolman and C. Meyer (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1939—1940). L. S. T.

Origin of banded iron deposits. W. G. Woolnough (*Econ. Geol.*, 1941, **36**, 465—489). L. S. T.

Hangnest dolerite sill, S. Africa. F. Walker and A. Poldervaart (*Geol. Mag.*, 1941, **78**, 429—450).—Chemical analyses are recorded and discussed. L. S. T.

Pipe deposits of the Copper Creek area, Arizona. T. H. Kuhn (*Econ. Geol.*, 1941, **36**, 512—538).—The pipes are probably the result of solutions acting on fractured areas. The Childs–Aldwinkle mine is a pipe deposit with Mo and Cu sulphides in the spaces between granodiorite breccia fragments, and generally replacing earlier gangue minerals. Molybdenite is the latest hypogene sulphide. L. S. T.

Pleonaste from Mineral Co., Nevada. V. P. Gianella (*Amer. Min.*, 1942, **27**, 462—463).—A chemical analysis [W. G. Hedquist] is given. L. S. T.

Origin and major structural control of igneous rocks and related mineral deposits. G. F. Loughlin (*Econ. Geol.*, 1941, **36**, 671—697). —A general review of igneous activity and mineral deposition. L. S. T.

Minor constituents in spodumene. A. Gabriel, M. Slavin, and H. F. Carl (*Econ. Geol.*, 1942, **37**, 116—125).—Spectrographic examination of 11 samples from 8 localities showed the presence of Fe, Mn, Ti, Ga, Na, and K in all samples, Sn in nine, and Rb in one. *X*-Ray and petrographic examination indicate that the impurities are present in spodumene (**I**) itself probably as isomorphous replacements. The Fe and other objectionable impurities may be present to an extent sufficient to limit the use of (**I**) in ceramics. The *X*-ray powder diagram for (**I**) is given. L. S. T.

Geology of Helvellyn and the southern part of Thirlmere. J. J. Hartley (*Quart. J. Geol. Soc.*, 1941, **97**, 129—162).—Chemical analyses of Stang End lava and of two rhyolites are recorded. L. S. T.

Etching phenomena in relation to " amphisymmetry " of crystals. A. P. Honess and H. R. Gault (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1911—1912).—Etching figures obtained with optically active org. solvents on calcite have been compared with those obtained on minerals of simple at. structure such as halite, fluorite, and synthetic periclase. The calcite etchings indicate two different symmetries when optically active and inactive solvents are used. L. S. T.

Mineralisation at the Polaris mine, Idaho. M. E. Willard (*Econ. Geol.*, 1941, **36**, 539—550).—Mineralogy and paragenesis of the veins, which are of hydrothermal origin, are discussed. L. S. T.

Structure and genesis of the Mount Prospect intrusive complex, N.W. Connecticut. E. N. Cameron (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1903).—Nickeliferous pyrrhotite deposits are associated with a basic group of intrusive rocks. L. S. T.

Structural control in European lead–zinc ores of the Mississippi Valley type. C. H. Behre, jun. (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1899—1900; cf. A., 1940, I, 239). L. S. T.

Mississippi Valley type lead–zinc deposits and the problem of mineral zoning. R. M. Garrels (*Econ. Geol.*, 1941, **36**, 729—744).—The position of minerals in hypogene veins has little apparent relation to mineral solubility. In the Mississippi Valley type Pb–Zn deposits, galena has behaved as if it were more sol. than sphalerite; this increased solubility is attributed mainly to the formation of chloride complexes. Experiments show that 2M-Cl′ is necessary to explain the observed mineral relations. High concns. may be a common feature of hypogene solutions, and dil. solutions are probably ineffective as metal carriers. L. S. T.

Vein-forming solutions. R. M. Garrels (*Econ. Geol.*, 1941, **36**, 663—665).—Dil. alkaline solutions are a very poor medium for ore transport. L. S. T.

Process of vein formation. H. M. Roberts (*Econ. Geol.*, 1941, **36**, 751—756). L. S. T.

Titaniferous sandstone near Buena Vista, Virginia. R. O. Bloomer and W. De Witt, jun. (*Econ. Geol.*, 1941, **36**, 745—747). L. S. T.

Large sanidine crystals from Utah. B. Stringham and N. C. Williams (*Amer. Min.*, 1940, **25**, 214). L. S. T.

Tungsten arcs [deposit belts]. P. F. Kerr (*Amer. Min.*, 1940, **25**, 208). L. S. T.

Albite and gold. E. Wisser (*Econ. Geol.*, 1941, **36**, 658—663).—A criticism (cf. A., 1941, I, 61). L. S. T.

Gold-bearing deposits in Eastern Transbaikal. M. P. Prosnjakov (*Sovet Zolotoprom.*, 1936, No. 3, 31—34). CH. ABS. (*e*)

Volcanic bombs from northern Arizona cinder cones. L. F. Brady and R. W. Webb (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1947). L. S. T.

Hat Creek lava flow. C. A. Anderson (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1945). L. S. T.

Method of comparing heavy minerals in sedimentary deposits. G. Rittenhouse (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1930—1931). L. S. T.

Origin of the gypsum sands of New Mexico. F. C. Potter (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1928). L. S. T.

Mechanism of plastic deformation and creep of solids. A. Nadai (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1926). L. S. T.

Compression creep of rubber and rock. J. S. DeLury (*J. Geol.*, 1942, **50**, 189—199). L. S. T.

Tertiary lavas of [the Isle of] Rum. S. I. Tomkeieff (*Geol. Mag.*, 1942, **79**, 1—13). L. S. T.

Martinez (Eocene) white sand, Contra Costa Co., California. F. Putlitz, W. A. Newton, and I. Klein (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1957). L. S. T.

Distribution of the Kordofan Sand (Anglo-Egyptian Sudan). J. M. Edmonds (*Geol. Mag.*, 1942, **79**, 18—30).—Distribution, character, origin, and age are discussed. L. S. T.

Titaniferous deposits of Sept-Iles, Quebec. C. Faessler and G. M. Schwartz (*Econ. Geol.*, 1941, **36**, 712—728). L. S. T.

Granite and ore. H. E. McKinstry (*Econ. Geol.*, 1941, **36**, 829—832).—A discussion. L. S. T.

Magmas and ores. A. M. Bateman (*Econ. Geol.*, 1942, **37**, 1—15). L. S. T.

Chromite deposits of California. A. C. Skerl (*Econ. Geol.*, 1942, **37**, 153—154). L. S. T.

Octahedron-like crystals of calcite [from the Magdalena district, New Mexico]. W. T. Schaller (*Amer. Min.*, 1942, **27**, 141—143). L. S. T.

Murmanite, a new mineral of the Lovozero tundra. M. L. Zolotar and A. S. Sacharov (*Redk. Met.*, 1936, **5**, No. 2, 37—39).—The mineral is found in nephelite syenites, its chief constituents being SiO_2, TiO_2, and Na_2O, with small amounts of Ta_2O_5 and Nb_2O_5. CH. ABS. (*e*)

Position of the phlogopite from Sljudjanka in table of genetic phase types in Siberia. B. Gavrusevitsch (*Trav. Inst. Lomonossov Acad. Sci. U.R.S.S.*, 1935, **5**, 99—113).—The % of SiO_2, Al_2O_3, MgO, and K_2O is essentially the same for all phlogopites, the FeO and Fe_2O_3 increasing with falling temp. during the time of formation. CH. ABS. (*e*)

Laba (Beden) deposit of chrysotile asbestos in the North Caucasus. P. Tatarinov (*Centr. Geol. Prospecting Inst.*, 1935, **2**, 1—29).—The origin of the deposit is discussed. CH. ABS. (*e*)

Chemical composition of the granitic rocks of Japan. J. Suzuki and T. Nemoto (*J. Fac. Sci. Hokkaido Imp. Univ.*, 1935, IV, **3**, 1—48).—Analyses are given for 135 rocks. CH. ABS. (*e*)

Eocene anauxite clays and sands in the Coast Range of California. V. T. Allen (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1899). L. S. T.

Feldspathic clay, Kaka, Nelson. B. L. Taylor (*New Zealand J. Sci. Tech.*, 1942, **23**, 33—43B).—Analyses of clay deposits from near Kaka are recorded. Two beds are suitable for the manufacture of light-coloured pottery, whilst other samples might be rendered suitable for use by washing. J. W. S.

Composition of ash of Tasmanian spore shale. G. W. Himus and S. Rudrakanchana (*J. Inst. Petroleum*, 1941, **27**, 446—447).—Tasmanite has been fractionated by suitable solvents into products with ash contents 4·65—90·4%. Since these ashes (Al_2O_3 11·7—12·1, SiO_2 71·05—75·35%) are very similar, it is concluded that the Al content of the shale does not support the theory of lycopodian origin. T. C. G. T.

Benzidine test for montmorillonite. J. Endell, R. Zorn, and U. Hofmann (*Angew. Chem.*, 1941, **54**, 376—377).—Tests on a large no. of samples of montmorillonite (**I**) from various parts of the world showed that, whilst the greater no. of samples were coloured blue by benzidine, a fair proportion gave no reaction. Quartz, kaolinite, a variety of mica, and nontronite from some localities gave positive reactions in the test, which is therefore unreliable for the identification of (**I**) in clay mixtures. No satisfactory explanation of the formation of the blue colour could be found. A. R. P.

Remains of fossil wood enclosed in a Tertiary lava on the Isle of Rum, Inner Hebrides. S. I. Tomkeieff and K. B. Blackburn (*Geol. Mag.*, 1942, **79**, 14—17).—The chemical analysis recorded and the microscopical examination show that the wood is replaced completely by SiO_2 (opal, chalcedony), Fe_2O_3,nH_2O, and chlorophaeite. L. S. T.

Coal veins of British Malaya. J. A. Richardson (*Geol. Mag.*, 1941, **78**, 451—462).—The veins are described, and their age and origin discussed. L. S. T.

Vegetable constituents of coals. W. C. Darrah (*Econ. Geol.*, 1941, **36**, 589—610).—New observations on the banded ingredients of bituminous coals and their combustion properties, particularly with reference to low-temp. carbonisation, are presented. All plant tissues and products may contribute to coal accumulation, and hence the lignin or cellulose origin of coal is meaningless. L. S. T.

Principles of sedimentation and the search for stratigraphic oil traps. W. C. Krumbein (*Econ. Geol.*, 1941, **36**, 786—810). L. S. T.

Carbohydrate theory of the origin of petroleum. N. A. Orlov, A. I. Gorskaja, and O. A. Radtschenko (*Chim. Tverd. Topl.*, 1935, **6**, 605—619).—Algæ were asphaltised in a rotating autoclave by treatment with 0·25N-Na_2CO_3 at 330° for 3 hr. The product was hydrogenated under high pressure with $MoS_2 + Al_2O_3$ catalyst. The product of hydrogenation yielded a considerable amount of paraffin hydrocarbons. CH. ABS. (*e*)

Oil formed from gastropods. H. Schneider (*Bull. Geol. Soc. Amer.*, 1939, **50**, 1958).—Evidence that oil has been formed from gastropods in limestone at Thistle, Utah, is presented. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

NOVEMBER, 1942.

I.—SUB-ATOMICS.

Energy of the $1s2s\,^3S$ state of the helium atom and related two-electron ions. T. S. Wheeler (*Proc. Roy. Irish Acad.*, 1942, **A**, **48**, 43—53).—Vals. of energy deduced from calculations, using the variation function of Pauling and Wilson, agree with experiment. The results confirm the approx. validity of the empirical rules concerning screening consts., viz., the interaction between an inner electron and the nucleus is not appreciably affected by an electron in an outer orbit and, for related atoms and ions, the screening effect of an inner on an outer electron is independent of the at. no. A simple, approx. expression connecting the energy of a state with the at. no. is given. A. J. M.

Polarisation and intensity dissymmetry of positive-ray glow. J. Stark (*Physikal. Z.*, 1942, **43**, 140—145).—From results of determinations of the longitudinal and transverse polarisation of lines and series in the spectrum of the positive-ray glow it is concluded that atoms have an axial structure. The existence of such polarisations cannot be reconciled with any theory of at. structure which supposes that the extra-nuclear electrons move in orbits about the nucleus, or are at rest on a cubic surface. The dissymmetry of the intensity of the positive-ray glow is determined by the direction of the magnetic moment of the excited electron, and the fact of its existence cannot be reconciled with the usual theories. The dissymmetry in the case of isomeric atoms is discussed. The theory is advanced that the elementary process of light emission from an atom is eddy-like and takes place in one direction only. A. J. M.

Dissymmetry of intensity of light emission in the axis of the electric field. J. Stark (*Physikal. Z.*, 1942, **43**, 146—151).—The dissymmetry of intensity of H and He lines in the axis of the electric field is discussed. Observations on the intensity ratio of the short- and long-λ components in a transverse magnetic field indicate that these atoms are arranged axially in the electric field, with a preponderance of anodic over cathodic arrangements. In a direction opposite to that of the electric field the intensity of the anodic arranged ortho-He atoms is > the intensity of the cathodic arranged atoms in the direction of the field. The converse holds for para-atoms. The phenomena agree with the view of the nature of the elementary process of light emission previously advanced (see preceding abstract). A. J. M.

Electrodeless discharge in mercury and the hyperfine structure of some Hg II lines. T. S. Subbaraya, R. L. Narasimhaiya, and S. Srinivasamurthy (*J. Mysore Univ.*, 1942, **B**, **2**, 81—87).—The $\lambda\lambda$ of observed lines are given. A. J. M.

First spark spectrum of thorium: classification and Zeeman effect data of Th II. J. R. McNally, jun., G. R. Harrison, and (Miss) H. B. Park (*J. Opt. Soc. Amer.*, 1942, **32**, 334—347).—From Zeeman patterns for >800 lines in fields up to 93,000 oersteds, and improved λ measurements, 1091 lines of Th II, arising from 219 levels, are classified. Data and classifications are tabulated. L. J. J.

Arc spectra with carbon electrodes for 2×10^{-4}, 2×10^{-5}, 2×10^{-6}, and 2×10^{-7} g. of erbium and thulium between 2200 and 5000 A. J. M. López de Azcona (*Anal. Fis. Quím.*, 1941, **37**, 184—191).—Persistencies of sensitive lines of Er and Tm are recorded. F. R. G.

Spectrum of Mira Ceti in the violet and near ultra-violet. H. Grouiller (*Compt. rend.*, 1942, **214**, 211—213).—Microphotometric examination of the spectrum of Mira Ceti indicates the presence of H, Mg, Al, Si, Ca, Ca^+, Sc, Sc^+, Ti, Ti^+, V, V^+, Cr, Mn, Fe, Fe^+, Co, Ni, Ni^+, Y, Y^+, Zr, Zr^+, Ba^+, La^+, Ce^+, Nd^+. A. J. M.

Photometric instruments used in spectrographic analysis.—See A., 1942, I, 341.

Outer levels of heavy atoms shown by high-frequency *X*-ray spectra. Bismuth. (Mlles) Y. Cauchois (*Compt. rend.*, 1942, **214**, 68—70).—Frequencies of *M* levels calc. from *L* emission and L_{III} absorption frequencies differ from *M* absorption frequencies. Differences calc. from recent data are tabulated for Ta, W, Ir, Pt, Au, Hg, Tl, Rb, Bi, Th, Pa, and U. Data for Bi are considered in detail (cf. Phelps, A., 1934, 1149). N. M. B.

Influence of oxygen, carbon dioxide, nitrogen, and mercury on the photo-effect of barium and potassium. A. V. Afanasieva and J. I. Lunikova (*J. Tech. Phys. U.S.S.R.*, 1935, **5**, 1000—1006).—Photo-electric emission from a Ba surface passes through a max. with increasing adsorption of O_2 or Hg. N_2 increases the emission to saturation, whilst CO_2 decreases it. Emission from K passes through a max. for CO_2, O_2, or N_2, but Hg always decreases emission. CH. ABS. (*e*)

Irregularities in the behaviour of certain photo-electic cells.—See A., 1942, I, 342.

Excitation of rarefied gases by high-frequency electromagnetic waves. G. Goudet, P. Herreng, and G. Nief (*Compt. rend.*, 1942, **214**, 62—65).—A new method for use at ~154 M-cycles (λ 1·94 m.) is described. N. M. B.

Measurement of the work of removal of an electron. E. N. Gribanov (*J. Tech. Phys. U.S.S.R.*, 1935, **5**, 1356—1361).—A method based on the heat of evaporation of electrons is described. Data are given for Th wires. CH. ABS. (*e*)

Electronic timer.—See A., 1942, I, 342.

Surface studies with the electron microscope.—See A., 1942, I, 342.

Electrometer for measurement of voltage on small ionisation chambers.—See A., 1942, I, 342.

Ion source with mass chromator for neutron generators.—See A., 1942, I, 342.

Scattering of potassium ions in mercury vapour. A. Rouse (*Proc. Iowa Acad. Sci.*, 1935, **42**, 152).—Measurements of the angular distribution loss of K ions scattered in Hg vapour are described. CH. ABS. (*e*)

Separation of isotopes and thermal diffusion. J. Kendall (*Nature*, 1942, **150**, 136—140).—A lecture. A. A. E.

Radioactivity of material exposed to the weather in Salamanca. J. Baltá Elías (*Anal. Fis. Quím.*, 1941, **37**, 180—183).—No radioactivity was found to have arisen from metals, especially Pb, exposed to the sun in old roofing. The electrometer employed was, however, less sensitive than that used by Maracineanu (A., 1928, 455) and Boutaric and Roy (A., 1930, 393). F. R. G.

Ionisation measurements on fast neutrons.—See A., 1942, I, 342.

High-voltage apparatus for atomic disintegration experiments.—See A., 1942, I, 342.

Energy distribution of the various modes of uranium-nucleus fission by neutrons. C. Magnan (*Compt. rend.*, 1942, **214**, 110—113).—There is evidence for the existence of two types of fission; corresponding energies are 100—60 and 90—70 Mc.v. N. M. B.

The "second maximum" of the shower transition curve of cosmic radiation. E. P. George, L. Jánossy, and M. McCaig (*Proc. Roy. Soc.*, 1942, **A**, **180**, 219—224).—Measurements of the Rossi curve with various counter systems show no indication of the second max. which has been reported. A spurious max. can be obtained in certain circumstances. G. D. P.

Calculations on the cascade theory with collision loss. H. J. Bhabha and S. K. Chakrabarty (*Proc. Indian Acad. Sci.*, 1942, **15**, **A**, 464—476).—Mathematical. W. R. A.

Solution of certain problems in quantum mechanics by successive removal of terms from the Hamiltonian by contact transformations of the dynamical variables. I. General theory. II. Power series in a co-ordinate and its conjugate momentum. The anharmonic oscillator by perturbation theory. L. H. Thomas (*J. Chem. Physics*, 1942, **10**, 532—537, 538—545).—Mathematical. Tables for the use of the method described are given. L. J. J.

Impossibility of a simple algebraic solution of a problem of magnetism. P. Rossier (*Arch. Sci. phys. nat.*, 1941, [v], **23**, *Suppl.*, 254—256).—It is impossible to express the relation between magnetic field and induction in simple algebraic form. J. W. S.

II.—MOLECULAR STRUCTURE.

Six-place table of the Einstein functions. J. Sherman and R. B. Ewell (*J. Physical Chem.*, 1942, **46**, 641—662).—Vals. of $x/(e^x - 1)$, $x^2e^x/(e^x - 1)^2$, and $-\log_e(1 - e^{-x})$ are tabulated for $x = 0$ to 3·000,

3·00 to 8·00, and 8·00 to 15·00 at intervals of 0·005, 0·01, and 0·05, respectively. C. R. H.

Band spectrum of manganese hydride, MnH. I. Structure of the λ 5677 and λ 6237 bands. T. E. Nevin (*Proc. Roy. Irish Acad.*, 1942, **A, 48**, 1—42).—The bands at 5677 and 6237 A. consist of at least 50 branches and are due to a $^7\Pi \rightarrow {}^7\Sigma$ transition. The $^7\Pi$ state is normal; the lower rotational levels of all the components are considerably perturbed. The 7 components of each $^7\Sigma$ rotational level are resolved, the separation of each of the 6 pairs of adjacent sub-levels of given K increasing linearly with K. The mol. consts. of the $^7\Sigma$ state, which is the ground state of the mol., are given provisionally as $B_e'' = 5{\cdot}6855$ cm.$^{-1}$; $I = 4{\cdot}923 \times 10^{-40}$ g.cm.^{2}; $r_e'' = 2{\cdot}230 \times 10^{-8}$ cm. A. J. M.

Goldstein–Kaplan bands of nitrogen. (Mme.) R. Herman and L. Herman (*Compt. rend.*, 1942, 214, 220—223).—The spectrum of N_2, excited in air between two glass plates a few mm. apart, contains some bands of the Goldstein system in the region λ 2745—3175 A., but they are displaced somewhat from their formerly observed positions. The vibrational analysis is given and the excitation of the N_2 is discussed. A. J. M.

Polarisability and internuclear distance. R. P. Bell (*Trans. Faraday Soc.*, 1942, **38**, 422—429; cf. A., 1938, I, 601).—Experimental vals. of the difference between the refractivities of H and D compounds, due to asymmetry of the zero-point vibrations, are used to calculate α', the variation of polarisability with internuclear distance $\bar{r}$, for H_2, HCl, HBr, and CH_4. Expressions are given, and vals. calc., for the effect of temp. on the mean $\bar{r}$ for H_2, HCl, HBr, N_2, O_2, and Cl_2. Vals. of α' obtained from the isotope effect are used to calculate the intensities of Raman lines for H_2, HCl, HBr, and CH_4, relative to one another and to the Rayleigh scattering. F. L. U.

Influence of temperature on the absorption spectrum of ozone (Huggins bands). D. Barbier and D. Chalonge (*Compt. rend.*, 1941, **213**, 650—652).—Measurements of the absorption coeff. of O_3 between —95° and 120° show that the max. vals. vary with temp., and that the min. vals. do not vary linearly with temp. Data are recorded for the max. 3401—3135 A. and the min. 3357—3130 A. The max. : min. absorption ratio varies approx. linearly with temp. for temp. <18°. L. J. J.

Effect of temperature on the absorption spectrum of ozone in the Huggins bands. E. Vassy (*Compt. rend.*, 1942, **214**, 219—220).—Results obtained are compared with those of Barbier *et al.* (preceding abstract). There is general agreement. A. J. M.

Ultra-violet absorption of solutions of sodium azide and hydrazoic acid. M. Bonnemay and E. T. Verdier (*Compt. rend.*, 1942, **214**, 228—230).—The ultra-violet absorption is a min. between 2450 and 2550 A. according to concn. Beer's law applies only for concns. between 0·0005N. and 0·0002N., and in the λ range 2500—2600 A. When monochromatic radiation is used the absorption is different from that observed when composite radiation is employed. Substances which readily decompose photochemically can, when exposed to radiation beyond a certain threshold λ, undergo either predissociation or activation. The absorption of non-activated mols. will be different from that of activated or predissociated mols. A. J. M.

Transmission of photographic layers in the ultra-violet. M. H. Sweet (*J. Opt. Soc. Amer.*, 1942, **32**, 324—325).—Developed Ag images show a narrow band of relatively high transmission at λ 320 mμ. Its effect on the accuracy of published results based on density measurements is indicated. L. J. J.

Ultra-violet absorption of simple metallic nitrates and of some double nitrates in the solid state. A. Berton (*Compt. rend.*, 1941, **213**, 653—655).—Data from powder reflexion spectra show a characteristic NO_3^- band with absorption max. and min. at 3000—2800 A. and 2650—2550 A., respectively, with a sharp long-λ limit at 3350—3000 A. Band positions and intensities depend on the cation and degree of hydration, and for double salts differ from those corresponding with the simple constituents. L. J. J.

Absorption spectrum of a βγ-unsaturated aldehyde. H. Böhme and J. Wagner (*Ber.*, 1942, **75**, [*B*], 614—617).—CHEt:CH·CHEt·CHO (**I**) exhibits a band at 230 mμ. in EtOH or 224 mμ. in *n*-C_6H_{14} and a longer-wave CO band at 317 mμ. in EtOH or 326 mμ. in *n*-C_6H_{14}. CHPr$^\alpha$:CEt·CHO (**II**) shows a less marked displacement of the CO band towards longer λ and a remarkably high extinction coeff. The mol. refractions of (**I**) and (**II**) are 39·3 and 39·7, respectively. H. W.

Absorption spectrum of some polymethine dyes. K. F. Herzfeld (*J. Chem. Physics*, 1942, **10**, 508—520).—Energy levels of a no. of polymethine dyes are calc. approx. by the Heitler–London–Pauling–Slater valency bond method and the Hückel–Hund–Mulliken mol. orbital method. The results by the two methods differ only in the numerical val. of the consts. and the final application of the formula. L. J. J.

Energy levels and colour of polymethine dyes. A. L. Sklar (*J. Chem. Physics*, 1942, **10**, 521—531).—The results of Herzfeld's calculations (cf. preceding abstract) are applied to the longest-λ electronic band of symmetrical and unsymmetrical polymethines. L. J. J.

Isomerism and absorption by cyclic pyrrole colouring materials. IV. Light absorption and constitution of chlorophyll derivatives. F. Pruckner (*Z. physikal. Chem.*, 1942, **A, 190**, 101—125).—The absorption spectra of various related groups of porphin and porphyrin derivatives in various solvents have been measured and compared. The results indicate that several porphyrins described by Knorr and Albers (A., 1941, I, 238) as "nuclear isomerides" should be regarded as distinct compounds. J. W. S.

Light absorption of polycyclic internally complex compounds. I. Salicylaldehyde-ethylenedi-imine complexes. A. von Kiss, P. Csokán, and G. Nyiri (*Z. physikal. Chem.*, 1942, **A, 190**, 65—80).—The extinction curves of glycine (**I**), salicylaldehyde-ethylenedi-imine (**II**), and their Na, K, Ca, Ba, Mg, Zn, Cu, Fe, Ni, and UO_2 complexes in EtOH have been determined at room temp. and over the λ range 2000—7000 A. Comparison measurements have also been made with Cu^{II}, Fe^{III}, Ni^{II}, and UO_2^{II} perchlorates, the extinction curves of which are due to the completely hydrated metal ions, absorption arising through excitation of the outermost electrons of the ion and the electrons of the co-ordinate linkages. The absorption by (**II**) is attributed to excitation of the π electrons of the C_6H_6 nucleus and of the CH:N group with one band due to the H-bridge. The absorption curves of the complex salts of (**I**) are combinations of the absorptions of the metal ion and of the co-ordinate linkages. With (**II**) complexes the org. mol. itself also contributes and various factors cause a modification of the extinction curve, particularly when the metallic ion has no absorption. J. W. S.

Ultra-violet absorption and photochemical decomposition of aqueous solutions of ascorbic acid in the ultra-violet.—See A., 1942, I, 304, 333.

Chemiluminescence of adsorbed dyes. H. Kautsky and G. O. Müller (*Naturwiss.*, 1942, **30**, 315).—When certain fluorescent dyes, chiefly of the rhodamine type, are adsorbed on SiO_2 gel or Al_2O_3 gel, and are oxidised by O_3, they show chemiluminescence, the colour of which is approx. that of the fluorescence. A. J. M.

Luminescence of luminol. I. Influence of acidity and effect of the addition of foreign substances on the fluorescence of luminol. K. Weber (*Ber.*, 1942, **75**, [*B*], 565—573).—Evidence is adduced for the following equilibria in solutions of luminol (**I**):

$$(\mathbf{I}) \rightleftharpoons NH_2\cdot C_6H_3\langle \begin{matrix} CO^-{:}N \\ CO{-}NH \end{matrix} (\mathbf{II}) + H^+;\ (\mathbf{II}) \rightleftharpoons NH_2\cdot C_6H_3\langle \begin{matrix} CO^-{:}N \\ CO^-{:}N \end{matrix} + H^+.$$

Only the neutral mols. fluoresce and, under otherwise identical conditions, the brightness of the fluorescence depends essentially on the p_H of the solution. Extinction is caused by foreign substances (acids, bases, acidic, basic, or hydrolysable salts) which change the acidity of the solution and hence displace the equilibria, by org. solvents (EtOH, $COMe_2$), which behave similarly towards the equilibria, by halogen ions (I′, CNS′, Br′, but only slightly by Cl′), by org. inhibitors [PhOH, metol, *o*-cresol, *o*-, *m*-, and *p*-$C_6H_4(OH)_2$, *o*-OH·C_6H_4·OMe, 1 : 2 : 3-$C_6H_3(OH)_3$, NH_2Ph] and by complex formation ($HgCl_2$). H. W.

Fatigue effect in luminescent materials. N. C. Beese and J. W. Marden (*J. Opt. Soc. Amer.*, 1942, **32**, 317—323).—Loss of luminescence efficiency with continued exposure to light of λλ 2537 and 3650 A. is found with cryst. Zn silicate, Cd borate, Zn Be silicate, Mg and Ca tungstate phosphors, fluorescent canary glass, rhodamine, and anthracene and fluorescein both dry and in solution in MeOH and EtOH. The effect increases with time and intensity of irradiation, reaching equilibrium in ~10 min. Zn silicate and canary glass show recovery after resting in the dark. ZnS and Zn–Cd sulphide phosphors show no fatigue with λ 3650 A. L. J. J.

Effect of flux on zinc sulphide and cadmium sulphide phosphors. H. Schlegel (*Naturwiss.*, 1942, **30**, 242).—The effect of the flux on the efficiency of sulphide phosphors is explained. If NaCl is added in the prep. of ZnS or CdS phosphors, a more intense phosphor is obtained. Na_2SO_4 is ineffective. Reactions occurring are $ZnS + 2NaCl \rightarrow ZnCl_2 + 2Na^+ + S''$; $ZnCl_2 + 2Na^+ \rightarrow 2NaCl + Zn^{++}$. A. J. M.

Study of the chlorobromomethanes by the Raman effect. (Mlle.) M. L. Delwaulle and F. François (*Compt. rend.*, 1942, **214**, 226—227).—The Raman spectra of $CClBr_3$, CCl_2Br_2, and CCl_3Br have been investigated, and the intensity, degree of polarisation, and classification of the lines are given. A. J. M.

Conductivity of gelatin–dye phosphors. L. Gombay (*Kolloid-Z.*, 1942, **99**, 28—35).—The conductivity (κ) of gelatin–dye phosphors decreases with rise of temp. to a min. and then increases to an approx. const. val. The initial decrease is greater for large than for small external e.m.f. and for cases where the external e.m.f. has been applied for a period prior to the rise in temp. Increase in external e.m.f. also lowers the val. of the const. κ attained at the higher temp. (~150°). The temp. at which min. κ is attained is ~40—50° and appears to depend little on the val. of the external e.m.f. or its preliminary duration. C. R. H.

Magnitude of the solvent effect in dipole-moment measurements. VI. Induced and mesomeric moments of the alkyl halides and the halogenobenzenes. A. Audsley and F. R. Goss (*J.C.S.*, 1942, 497—500).—The prep. of tert.-*amyl fluoride*, b.p. 38°/458 mm., is described. Dipole moments and solvent-effect consts. at 20° for CCl_4 solutions of *n*- and *tert.*-$C_5H_{11}F$, $Bu^{\alpha}Br$, $Bu^{\alpha}Cl$, $Bu^{\gamma}Br$, and PhI are recorded. The influence of the spatial effect on each of the three parts of the radical effect (cf. A., 1942, I, 258) varies through a series of alkyl halides in the order F > Cl > Br > I (negligible). The mesomeric moment (μ_M) for aromatic halides can be expressed by $\mu_M = 1{\cdot}15 - 0{\cdot}012Z$ (Z = at. no.). C. R. H.

Scattering of light by an aggregate of small dielectric particles. R. Landshoff (*J. Physical Chem.*, 1942, **46**, 778—781).—Mathematical. C. R. H.

Molecular volume nomograph for liquid alkanes. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 797).—From the data of Egloff and Kuder (A., 1942, I, 195) a nomograph to permit computation of the mol. vols. of liquid *n*-hydrocarbons from CH_4 to C_8H_{18} at −170° to 70° has been constructed. J. W. S.

Applicability of the Hartmann formula for calculation of dispersion in the near infra-red region of the spectrum. V. G. Vafiadi and M. S. Zelitzer (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 53—59).—Data are given for fluorite, NaCl, quartz, and optical glass, and corrections to the formula are discussed. Ch. Abs. (*e*)

Specific dispersion of pure hydrocarbons. R. E. Thorpe and R. G. Larsen (*Ind. Eng. Chem.*, 1942, **34**, 853—863).—The sp. dispersions (x) of a large no. of pure hydrocarbons have been analysed. They can be predicted by the formula $x = (98{\cdot}4p + 98{\cdot}3n + 189{\cdot}3u)/c$, where p and n are the nos. of paraffinic and naphthenic C atoms, u the apparent no. of C atoms associated with double linkings, and c is the total no. of C atoms in the mol. In conjugated double linkage systems the conjugation increases the effect of these linkings and the method of calculating this increase is discussed in detail. The possibility of utilising determinations of x in identifying the structures of hydrocarbons is also discussed. J. W. S.

Dispersion of ultra-short waves in polar liquids with multiple relaxation times. G. Klages (*Physikal. Z.*, 1942, **43**, 151—166).—The dispersion of waves of λ 8 cm.—2 m. in liquids which, on account of their form, polarity, and freely rotating polar group, have a no. of relaxation times, is determined with 3-chlorodiphenyl, and octyl, decyl, lauryl, and cetyl chlorides. If a liquid has two relaxation times which are not widely different, there is a smoothing out of the dispersion curve. In the case of the aliphatic chlorides, a relaxation time distribution is discussed in connexion with the inner rotation of the mol. A. J. M.

Influence of lyotropic substances on the specific rotation of β-*l*-glucosan. J. R. Katz and J. Seiberlich (*J. Physical Chem.*, 1942, **46**, 640—641).—Data for the sp. rotation of β-*l*-glucosan mixed with various lyotropic substances confirm earlier conclusions that compound formation is unlikely. C. R. H.

Temperature concept. M. K. Barnett (*J. Physical Chem.*, 1942, **46**, 715—723).—Theoretical. A method for ordering any given no. of bodies, existing in certain states, into a "temp. series" is developed, and the derivation of an "arbitrary temp. scale" and its nature are discussed. C. R. H.

Joule's law and the laws of thermodynamics. (A) J. Palacios. (B) O. R. Foz (*Anal. Fis. Quím.*, 1941, **37**, 199—203, 204—206).—(A) A proof of Joule's law.

(B) The author's previous contention (A., 1941, I, 292) that Joule's law is empirical is upheld. F. R. G.

Natural periodic system of the compounds. III. J. N. Frers (*Z. anorg. Chem.*, 1942, **249**, 281—292).—Theoretical. F. J. G.

Statistical distribution laws for rate processes. I. [Systems in which velocities are non-Maxwellian.] II. Non-uniform distributions. B. Longtin (*J. Chem. Physics*, 1942, **10**, 546—550, 551—556).—I. The method of deriving distribution laws for systems not in equilibrium is outlined, *e.g.*, for mol. groups having non-Maxwellian velocities.

II. Forms of statistical distribution law suitable for rate processes are determined. L. J. J.

Structure of substituted ethylenes and their isomerisation, polymerisation, and "peroxide addition" reactions. R. A. Harman and H. Eyring (*J. Chem. Physics*, 1942, **10**, 557).—*cis*–*trans*-Isomerisation, polymerisation, and peroxide addition of ethylenic compounds show two types of mechanism: (*a*) triplet mechanism involving transition from singlet ground state with opposite electron spins into triplet state with like spins ~25 kg.-cal. above, (*b*) singlet mechanism involving rotational adiabatic transition to an upper singlet state ~40 kg.-cal. above. In each case the double bond dissociates to a single bond. (*a*) operates in catalysis by paramagnetic substances, free radicals and atoms, *e.g.*, in the initiation of polymerisation in styrene, reversal of Markovnikov rule by paramagnetic catalysts. (*b*) operates with catalysts of the Friedel–Crafts type. L. J. J.

Inorganic compounds of nitric oxide. Structure and valency theory of inorganic nitric oxide complexes. W. Hieber and F. Seel (*Z. anorg. Chem.*, 1942, **249**, 308—324).—The structures and behaviour of a no. of inorg. NO compounds are discussed in the light of the theory that the NO functions as the ion NO^+, which is then co-ordinatively bound to the central atom. F. J. G.

Chemical behaviour and structure of the azide group N_3. E. Oliveri-Mandalà and G. Caronna (*Gazzetta*, 1941, **71**, 182—188).—Theoretical. On chemical grounds a cyclic formula is favoured for HN_3 and a linear formula for PhN_3. E. W. W.

Resonance in substituted diphenyls.—See A., 1942, II, 354.

Influence of the "hydrogen bond" on magnetic susceptibility. H. S. Venkataramiah (*J. Mysore Univ.*, 1942, **B**, **3**, 19—22).—The magnetic susceptibility of solutions of alcohols in CCl_4 is > the calc. val. owing to breaking up of H bonds. For solutions of $CHCl_3$ in Et_2O, the susceptibility is < the calc. val., owing to association of unlike mols. A. J. M.

Mean free path of gas molecules in mercury vapour. J. A. Eldridge (*Proc. Iowa Acad. Sci.*, 1935, **42**, 155).—The mean free paths were obtained for H_2, He, N_2, CO_2, CH_4, C_2H_6, C_3H_8, *n*- and *iso*-C_4H_{10} in Hg vapour, by observing the decrease in intensity as a beam of the gas was passed through the vapour. The vals. were < those deduced from η data. Ch. Abs. (*e*)

Mechanism of metallic friction. F. P. Bowden and D. Tabor (*Nature*, 1942, **150**, 197—199).—A lecture. A. A. E.

III.—CRYSTAL STRUCTURE.

Diffraction of *X*-rays by liquid oxygen. P. C. Sharrah and N. S. Gingrich (*J. Chem. Physics*, 1942, **10**, 504—507).—Liquid O at 89° K. shows an intense peak at $\sin\theta/\lambda = 0{\cdot}157$ and very weak peaks at 0·35 and 0·5. Corresponding vals. at 62° K. are 0·159, 0·35, 0·5. At. distribution peaks are at 1·3, 2·2, 3·4, 4·2 A. at 89° K. and 1·25, 2·15, 3·2, 4·1 A. at 62° K., and are ascribed to O_2, O_3, and higher mol. aggregates, respectively. L. J. J.

Indexing of *X*-ray goniometer photographs. G. Menzer (*Z. Krist.*, 1941, **103**, 403—414).—A simplification of Schneider's method (*ibid.*, 1928, **69**, 41) employing polar co-ordinates, suitable for construction of reciprocal lattices from Weissenberg and Schiebold–Sauter *X*-radiograms, is described. A. J. E. W.

Photometric instruments used in *X*-ray diffraction.—See A., 1942, I, 341.

Determination of absolute from relative *X*-ray intensity data. (A) S. H. Yü. (B) A. J. C. Wilson (*Nature*, 1942, **150**, 151, 152).—Mathematical. A. A. E.

***X*-Ray diagram of dehydrated muscle.**—See A., 1942, III, 715.

Fine structure of wool keratin. H. Nowotny and H. Zahn (*Z. physikal. Chem.*, 1942, **B**, **51**, 265—280).—*X*-Ray diffraction evidence for the fine structure of wool and other forms of keratin is discussed. O. D. S.

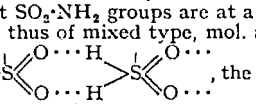
Crystal orientation in tarnish layers (Anlaufenschichten). G. M. Schwab (*Z. physikal. Chem.*, 1942, **B**, **51**, 245—264).—The orientation of films formed by chemical reaction on single crystals is investigated by *X*-ray reflexion photography. AgCl and AgBr on Ag, AgCl on AgBr, and AgBr on AgI are oriented. Unoriented films are formed by CuCl, CuI, and Cu_2O on Cu, PbS and PbSe on Pb, and AgBr on AgCl. Orientation occurs when the film has a larger mol. vol. than the ground crystal and the two lattices contain planes in which the spacing of similar atoms corresponds periodically with an error ±5%. O. D. S.

***X*-Ray study of alloys of composition AB_2 of iron-group metals with titanium, zirconium, niobium, and tantalum.** H. J. Wallbaum (*Z. Krist.*, 1941, **103**, 391—402).—Powder *X*-radiograms show that Mn_2Zr, Mn_2Nb, Mn_2Ta, Fe_2Nb, Mn_2Ti, and Fe_2Ta have $MgZn_2$ (*C*14 type) structures (*a* 5·029, 4·865, 4·861, 4·821, 4·81, 4·80; *c* 8·223, 7·955, 7·936, 7·866, 7·88, 7·84 A.; *c*/*a* 1·635, 1·635, 1·634, 1·632, 1·638, 1·633, respectively). $Fe_{2\cdot19}Zr_{0\cdot81}$, $Co_{2\cdot19}Nb_{0\cdot81}$, and $Co_{2\cdot19}Ta_{0\cdot81}$ have $MgNi_2$ (*C*36 type) structures (*a* 4·952, 4·729, 4·722; *c* 16·12, 15·43, 15·39 A.; *c*/*a* 1·628, 1·631, 1·630), whereas Fe_2Zr, Co_2Nb, Co_2Ta, and Co_2Zr have $MgCu_2$ (*C*15 type) structures (*a* 7·039, 6·745, 6·719, 6·887 A.). Indexed visually-estimated intensities and complete interat. distance data are tabulated. Ni gives compounds of the type Ni_2X instead of Laves phases (Ni_2X); these have ordered, partly deformed, close-packed structures. A. J. E. W.

Arrangement of atoms in amorphous solid substances. R. Glocker and H. Hendus (*Z. anorg. Chem.*, 1942, **48**, 327—331).—With strictly monochromatic radiation, *X*-ray photographs of explosive Sb and glassy Se have been obtained which show several clearly-marked interference bands. Interpretation shows that the at. arrangement is similar to that in liquids, each Sb atom having four nearest neighbours and each Se atom two. The concept "amorphous" is discussed. F. J. G.

Distribution of metallic atoms in two-component glasses. J. S. Lukesh (*Proc. Nat. Acad. Sci.*, 1942, **28**, 277—281).—If the radial distribution curve of a Na_2O–SiO_2 glass, obtained by application of the Fourier integral to the intensity curve from the *X*-ray diffraction pattern, is compared with the curve for a pure SiO_2 glass, and the ordinates of the second curve are subtracted from those of the first, a curve is obtained the peaks of which are due to the radial distribution of the scattering matter about the Na, thus giving information about the distribution of the metallic atoms. The max. of the differential curve correspond with the interat. distances of the additional metal in the two-component glass. Sources of error involved in the method are discussed. The method is also applied to Na_2O– and K_2O–B_2O_3 glasses, but the error in these cases is greater and the curves are more difficult to interpret. The method can readily be extended to liquids and solutions, and, in some cases, to gases. A. J. M.

New Fourier series technique for crystal structure determination. M. J. Buerger (*Proc. Nat. Acad. Sci.*, 1942, **28**, 281—285).—The principle of the differential curve obtained by Lukesh (cf. preceding abstract), which gives the interat. distances of metal atoms in a two-component system, has been applied to Fourier functions, the difference function for two crystals of related structure being found. The properties of the Patterson diagram and the difference diagram are discussed. It is not easy to interpret the difference diagram in terms of the plane pattern projection of a crystal, though it is much easier than deriving the latter from a Patterson diagram. Difference diagrams can be obtained directly without first plotting Patterson diagrams. The difference diagrams can be used to determine the nature of solid solutions. A. J. M.

Structure of sulphanilamide. G. Giacomello and (Signa.) P. Riverso (*Gazzetta*, 1941, **71**, 209—216).—Sulphanilamide is shown by *X*-ray diffraction to have a rhombic cell with *a* 14·8, *b* 5·6, and *c* 18·4 A., space-group D_{2h}^{15}, 8 mols. per unit cell. Fourier projection on the *bc* plane, and Patterson projection, show that the aromatic nuclei are at normal intermol. distances, but the O and the N atoms of different and adjacent $SO_2{\cdot}NH_2$ groups are at a closer (*i.e.*, ionic) distance. The lattice is thus of mixed type, mol. and filiform ionic, embodying the system  , the presence of which may be relevant to the pharmacological action of sulphanilamide. E. W. W.

Crystal structure of mercury chlorobromide, $Hg(Cl,Br)_2$. W. Scholten and J. M. Bijvoet (*Z. Krist.*, 1941, **103**, 415—419; cf. A., 1939, I, 524).—The β-phase ($HgBr_2$ 55—60 mol.-%) has (from rotation *X*-radiograms) *a* 6·78, *b* 13·17, *c* 4·10 A., $a:b:c = 0{\cdot}515:1:0{\cdot}301$; 4 mols. per unit cell; $\rho_{calc.}$ 5·62; space-group $P2_12_12_1$ (V^4). At. parameters are fully determined, partly by analogy with $HgCl_2$; the structure contains linear X–Hg–X mols. A. J. E. W.

***X*-Ray studies on the oxyhalide minerals nadorite (ochrolite), $PbSbO_2Cl$, and ekdemite.** L. G. Sillén and L. Melander (*Z. Krist.*, 1941, **103**, 420—430).—Nadorite (shown by *X*-radiograms to be identical with ochrolite) has (from rotation and Weissenberg photographs) *a* 5·59$_1$, *b* 5·43$_1$, *c* 12·20 A., $a:b:c = 1:0{\cdot}971:2{\cdot}181$; 4 mols. per unit cell; $\rho_{calc.}$ 7·05; space-group D_{2h}^{17}. Complete at. parameters are derived from observed intensities; the structure is closely related to that of a tetragonal phase (*a* 3·887, *c* 12·26 A.), also $PbSbO_2Cl$, which is formed with nadorite and a phase containing no Sb on fusing a mixture of $PbCl_2$, PbO, and Sb_2O_3; the tetragonal phase is isomorphous with "X_1" compounds of the M_3O_2X type (cf. A., 1939, I, 457). Ekdemite is pseudo-tetragonal (*a* 10·8, *c* 25·6 A.; symmetry $4/mmm$), the crystals containing uni- and bi-axial phases; it contains no As^V and cannot be synthesised from $PbCl_2$, PbO, and As_2O_3. (Cf. A., 1941, I, 380.) A. J. E. W.

Crystal lattice of colemanite ($Ca_2B_6O_{11},5H_2O$). Z. Dér (*Z. Krist.*, 1941, **103**, 431—433).—From Laue and Schiebold *X*-radiograms, colemanite has *a* 8·61, *b* 11·12, *c* 6·10 A., $a:b:c = 0{\cdot}7743:1:0{\cdot}5480$; *V* 548·1 cu. A.; 2 mols. per unit cell; probable space-group C_{2h}^5. A. J. E. W.

Isotypism of $PbK_2(SO_4)_2$ and $Ca_3(PO_4)_2$. H. Strunz (*Naturwiss.*, 1942, **30**, 242).—*X*-Ray investigation shows that palmierite, $PbK_2(SO_4)_2$, and whitlockite, $Ca_3(PO_4)_2$, are of similar structural type and have similar formulæ. They are not, however, isomorphous. A. J. M.

Crystallo-chemical classification of inorganic compounds. H. Strunz (*Naturwiss.*, 1942, **30**, 243).—A classification is proposed in which both chemical and crystallographic properties are taken into account. A. J. M.

Distribution of autelectronic emission from single crystal metal points. II. Adsorption, migration, and evaporation of thorium, barium, and sodium on tungsten and molybdenum. M. Benjamin and R. O. Jenkins (*Proc. Roy. Soc.*, **A**, **180**, 225—235; cf. A., 1941, I, 32).—Migration occurs at relatively low temp. *e.g.*, 870° for Th on a W or Mo point, and for an optimum thermionic covering there is a unique distribution of the migrating atoms on the metal crystal. Certain crystal zones are avoided by the migrating atoms. Evaporation takes place preferentially from certain zones, and the differences in the temp. for complete migration and for evaporation lead to an explanation of the fact that migration is not always observed with Ba. The study of thoriated W shows that diffusion of Th occurs through the crystal lattice along certain preferred directions and that the final distribution of Th is identical with that obtained by deposition from an external source. G. D. P.

Orientation of liquid crystals by rubbed surfaces. P. Chatelain (*Compt. rend.*, 1942, **214**, 32—34; cf. A., 1942, I, 291).—Rubbing of a surface causes orientation of electric dipoles, introduced by impurities, in the plane of the surface; this induces a corresponding orientation of mols. in a superimposed layer of a nematic liquid. Experiments with *p*-azoxy-anisole and -phenetole are described which indicate that the initial dipole orientation may also be caused by growth of solid crystals on the surface. A. J. E. W.

Interpretation of etched figures on aluminium crystal surfaces. I. N. Stranski (*Ber.*, 1942, **75**, [*A*], 105—113).—A lecture. H. W.

Molecular rotation in organic crystals. A. H. White (*Bell Labs. Rec.*, 1936, **15**, 11—14).—In contrast to aromatic compounds, the dielectric const. of *d*-camphor, *cyclo*-hexene, -hexanol, and -hexanone, and chloro*cyclo*hexane does not increase abruptly on solidification, showing that mol. rotation persists in the solid state. At the lower transition temp., where this rotation begins, the heat capacity increases with temp. Two strainless forms of the C_6H_{12} ring exist, and illustrate how the change in at. vibration with temp. is possible. The increase in mol. symmetry caused by changes in the at. vibration probably causes the concurrent mol. rotation. Ch. Abs. (*e*)

Plasticity of zinc. M. N. Davidenkov and I. N. Miroljubov (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 60—77).—When Zn monocrystals are stretched at a const. rate of 5×10^{-3} mm. per hr., the tension diagrams obtained are the same as those from more rapid stretching, both as to the limiting plasticity and the presence of irregular jumpy changes in the pull required. Ch. Abs. (*e*)

Isomorphism and allotropy in compounds of the type A_2XO_4. M. A. Bredig (*J. Physical Chem.*, 1942, **46**, 747—764).—A detailed interpretation of earlier data (cf. A., 1932, 469 and subsequently) on the formation and structure of Ca phosphates, silicophosphates, and alkali phosphates is presented. C. R. H.

Liquid crystalline and isotropic states with special reference to *p*-azoxyanisole. G. W. Stewart and H. R. Letner (*Proc. Iowa Acad. Sci.*, 1935, **42**, 153).—A review and discussion. Ch. Abs. (*e*)

Distortion of the zinc crystal lattice during mechanical twinning. E. S. Jakovleva and M. D. Motschalov (*J. Tech. Phys. U.S.S.R.*, 1935, **5**, 1085—1092).—The centres of recrystallisation occur on the border of the twin and the original crystal. At 300—400°, they were observed in places not containing twins. Ch. Abs. (*e*)

Liquid-crystalline substances with side-chains of the type $OR{\cdot}[CH_2]_n{\cdot}O$.—See A., 1942, II, 361.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Significance of low-temperature research.—See A., 1942, I, 341.

Velocity of sound in liquids and molecular volume. M. R. Rao (*J. Mysore Univ.*, 1942, **B**, **2**, 89—93).—The velocity of sound (v) in a liquid of density ρ and mol. wt. M is given by $v^{\frac{1}{3}}(M/\rho) = R$, where R is a const. for a given liquid and is an additive function of the chemical composition. The function may be written $R = a(\theta_c/M)^{\frac{1}{3}}V_c$, where θ_c is the crit. temp. and V_c is the crit. vol. a is const. for a large no. of liquids. A. J. M.

Effect of ultrasonic waves on velocity of corrosion of copper.—See A., 1942, I, 333.

Equations for the specific heats of gases. J. C. Smallwood (*Ind. Eng. Chem.*, 1942, **34**, 863—864).—The sp. heats (c_p) of O_2, N_2, CO, H_2O, CO_2, and air can all be represented by relations of the form $c_p = a + xT^{-\frac{1}{2}} + yT^{-1} + zT^{-2}$, where a, x, y, and z are consts. the vals. of which are tabulated. J. W. S.

Variation of the vertical temperature gradient in certain states of some fluids. F. Morán (*Anal. Fis. Quím.*, 1941, **37**, 192—198).—The variation of sp. heat with altitude is expressed as a function of temp. F. R. G.

Specific heat as a function of temperature. F. Morán (*Anal. Fis. Quim.*, 1941, **37**, 405—412).—The state in which the sp. heat is a uniform function of temp. is called thermotropy. Formulæ are developed to express this function. F. R. G.

Measurement of latent heat [of water] by the gas-current method. J. A. Goff and J. B. Hunter (*J. Appl. Mech.*, 1942, **9**, A22—25).—The apparatus used is diagrammatically described and the technique outlined. Sufficiently reliable vals. of the interaction const. for mixtures of air and H_2O vapour have been determined to permit an adequate thermodynamic analysis of the gas-current method. R. B. C.

Thermal properties and constitution. XIV. M.p. and b.p. of the elements. Werner Fischer (*J. pr. Chem.*, 1941, [ii], **158**, 200—210).

—The regularities which are observed when the m.p. and b.p. of the elements are plotted according to the periods of the periodic table are discussed. J. L. E.

Physical constants of low-boiling hydrocarbons. R. Matteson and W. S. Hanna (*Oil and Gas J.*, 1942, **41**, No. 2, 33—37).—Mol. wts., C : H ratios, m.p., b.p., crit. consts., liquid density (g. per ml., A.P.I., and lb. per gal.), gas d, gas-law deviation factor, C_p/C_v, heats of combustion, vaporisation, and fusion, air required for combustion, limits of inflammability, n_D, NH_2Ph points, and C_8H_{18} nos. are given for a no. of paraffin and olefine hydrocarbons, C_6H_6, PhMe, xylenes, MeOH, EtOH, and a few other common compounds. J. W.

Relations between physical properties of paraffin hydrocarbons. A. W. Francis (*Ind. Eng. Chem.*, 1941, **33**, 554—560).—B.p., m.p., d, n, NH_2Ph point (A), and C_8H_{18} no. (O) for the paraffins up to $C_{10}H_{22}$ are tabulated and empirical equations for determining b.p., d, and n for some of the compounds have been devised. For each group of isomeric paraffins A is nearly a linear funtion of d or n, and O is nearly a linear function of $1000d - 2 \times$ b.p. and of b.p. $+ A$. C. R. H.

Determination of volatility of organic substances. L. Kofler and H. Doser (*Angew. Chem.*, 1942, **55**, 13—14).—A method for determining the approx. temp. of sublimation of an org. substance is described; the results are relative, the vals. obtained being dependent mainly on the rate of heating. A linear relation exists between m.p. and average sublimation temp. of org. substances, the difference between the two vals. increasing with increase in m.p. F. O. H.

Relation between b.p. and critical temperatures and pressures. C. Chen and C. Tseng (*J. Chem. Eng., China*, 1936, **3**, 110—112).—The following empirical equation is given: $T_b = 0{\cdot}53796T_c + 0{\cdot}23755P_c$, where T_b = b.p., and T_c and P_c are the crit. temp. and pressure. Ch. Abs. (*e*)

Gas imperfections determined from heat of vaporisation and vapour pressure. C. F. Curtiss and J. O. Hirschfelder (*J. Chem. Physics*, 1942, **10**, 491—496).—Deviations from the gas laws calc. by combining heats of vaporisation and v.p. data with the Clausius–Clapeyron equation are compared with experimental second virial coeffs. for a no. of gases and vapours. Vals. for dimerisation in HI, $NHMe_2$, MeOH, EtOH, and HCN are obtained. L. J. J.

Vapour density of mercury. W. Klemm and H. Kilian (*Z. physikal. Chem.*, 1942, **B**, **51**, 306—308; cf. A., 1942, I, 167).—An error in calculation is corr. The deviations from the ideal gas laws for Hg are in the direction expected for a real gas. Hg vapour is monat. O. D. S.

Vapour pressure nomograph for unsaturated hydrocarbons. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 553).—A nomograph giving the v.p. of 8 unsaturated hydrocarbons at temp. —130° to 20° has been constructed. C. R. H.

Equation of state and the heat of phase transformation in solid bodies. J. A. Trotzki (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 125—136).—The formula $\phi = qRT^2(2a_2 - 3a_1)$ is derived thermodynamically, where ϕ = the heat of transformation from phase I to phase II, and a_1 and a_2 are the linear expansion coeffs. of I and II. The calc. val. for the $\gamma \rightarrow \beta$ transition in Fe is 375 kg.-cal. per g.-atom; the observed val. is 372 kg.-cal. Ch. Abs. (*e*)

Calculation of the efficiency of the Carnot cycle for a given substance. F. Morán (*Anal. Fís. Quím.*, 1941, **37**, 549—556).—The calculation is more complex but more logical than for a perfect gas. F. R. G.

Tension of vaporisation and sublimation. J. P. E. Duclaux (*Compt. rend.*, 1942, **214**, 78—80; cf. *ibid.*, 1941, **213**, 482, 674).—Mathematical. N. M. B.

Adiabatic compressibilities of oils. (Mrs.) Sree (*J. Mysore Univ.*, 1942, **B**, **2**, 95—97).—Determination of the velocity of ultrasonic waves in oils enables the adiabatic compressibilites of the oils to be calc. Results are given for almond, mustard, coconut, cod-liver, shaliverol, thyme, and turpentine oils. A. J. M.

Viscosity–temperature function of liquids. E. P. Irany (*Phil. Mag.*, 1942, [vii], **33**, 685—688).—The author claims to have anticipated Nissan (cf. A., 1942, I, 50) with his method of graphical analysis (cf. A., 1938, I, 610). C. R. H.

Relationships between viscosity and surface tension of liquids. R. C. Tripathi (*J. Indian Chem. Soc.*, 1942, **19**, 51—54).—Buehler's equation (A., 1938, I, 63) has been modified to $\log\log\eta = m\gamma^{\frac{1}{4}} + c$, where m is a const. characteristic of each liquid, and c is a const. The equation is satisfactory for simple and associated liquids and at temp. > their b.p. D. F. R.

Viscosity of propane, butane, and *iso*butane. M. R. Lipkin, J. A. Davison, and S. S. Kurtz, jun. (*Ind. Eng. Chem.*, 1942, **34**, 976—978).—The η of liquid C_3H_8, *n*- and *iso*-C_4H_{10}, determined over a wide temp. range, vary linearly with temp. C. R. H.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Dew points and b.p. for mixtures of nitrogen with carbon monoxide at pressures up to seventeen atmospheres. F. Schtekkel (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 137—140).—Data are given for the range 84—113° K. At 17 atm. the liquid and vapour phases have almost the same composition. The dew-point pressure is given by $P_H = (P_{CO}P_{N_2})/P_{CO}X_{N_2} + P_{N_2}X_{CO})$, and the b.p. pressure by $P_K = P_{CO} + X_{N_2}(P_{N_2} - P_{CO})$, where P_H and P_K are the pressures of initial and complete condensation and X is the composition of the mixture in mols.-% CO. Ch. Abs. (*e*)

Critical states of two-component paraffin systems. F. D. Mayfield (*Ind. Eng. Chem.*, 1942, **34**, 843—849).—The crit. temp. of binary mixtures of lower *n*-hydrocarbons vary almost linearly with the composition in wt.-%. The crit. pressure, however, is always > the val. calc. by this law, and an empirical relation which permits the approx. prediction of the crit. temp.–crit. pressure–composition relationship has been developed. Except for the systems CH_4–C_5H_{12} and CH_4–C_6H_{14} the calc. vals. are within 1·3% of the observed vals. J. W. S.

***P–V–T–x* relations of the system propane–*iso*pentane.** W. E. Vaughan and F. C. Collins (*Ind. Eng. Chem.*, 1942, **34**, 885—890).—The P–V–T-composition relationships of five C_3H_8–$CHMe_2Et$ mixtures have been studied at 0—300° and 2—80 atm. The crit. data for the system are presented and the phase equilibrium consts. are calc. J. W. S.

Changes in volume on mixing solutions. P. W. Parsons and F. J. Estrada (*Ind. Eng. Chem.*, 1942, **34**, 949—952).—The " shrinkage factor " (F) is a function of the composition of a solution, its d, and the d of the pure components. Vol. fraction- and wt. fraction-F for EtOH–H_2O mixtures and wt. fraction-F for H_2SO_4–H_2O mixtures have been graphically recorded, and from the graphs amounts of vol. change on mixing EtOH or H_2SO_4 with H_2O can be calc. C. R. H.

Azeotrope of nicotine and water. D. F. Kelly, (Miss) M. J. O'Connor, and J. Reilly (*J.C.S.*, 1942, 511—513).—An azeotropic mixture of nicotine (**I**) and H_2O boils at 99·6°/760 mm. and contains 2·45% of (**I**). C. R. H.

Vapour pressure of mixtures of chlorosulphonic acid and sulphur trioxide. S. A. Kudjavtzev, B. D. Melnik, I. G. Lesochin, and B. A. Kopilev (*J. Appl. Chem. Russ.*, 1941, **14**, 478—482).—The v.p. of $ClSO_3H$ is 8·65 mm. Hg at 20° and 24·80 mm. at 50°. Vals. are given for the partial v.p. of four SO_3–$ClSO_3H$ mixtures between 20° and 50°. J. J. B.

Useful solvent for the determination of mol. wt. according to Rast. G. Wendt (*Ber.*, 1942, **75**, [*B*], 425—429).—The use of the lactam, m.p. 196°, of *cis*-4-aminohexahydrobenzoic acid is recommended. It is obtained by rapid distillation of the mixture of *cis*- and *trans*-H_6-acids obtained by hydrogenation (PtO_2 in H_2O) of *p*-$NH_2{\cdot}C_6H_4{\cdot}CO_2H$. It is particularly suitable for the determination of mol. wt. of tripeptides, disaccharides, and nucleosides. H. W.

Viscosity of zinc chloride solutions of various concentrations. P. A. Kopuitschev and V. A. Gusikov (*Ugol*, 1935, No. 120, 109—110).—Data for fresh and used aq. $ZnCl_2$ employed in flotation are given. Ch. Abs. (*e*)

Dilatometric studies on supersaturation. I. A. C. Chatterji and R. Gopal (*J. Indian Chem. Soc.*, 1942, **19**, 55—60).—When aq. solutions of KNO_3, $NaNO_3$, K_2SO_4, NaOAc, or $H_2C_2O_4$ are cooled from the unsaturated to the supersaturated state sudden vol. changes do not occur until crystallisation takes place, either automatically or by inoculation. No vol. changes occur at the lower limit of the metastable range. D. F. R.

Graphical method for interconversion of ternary compositions. K. H. Sun and A. Silverman (*Ind. Eng. Chem.*, 1942, **34**, 872—873).—A graphical method for determining wt.-%, mol.-%, or vol.-% compositions of ternary systems from data expressed in another form is described. J. W. S.

Nature of the phases formed by the mutual diffusions of copper–zinc and iron–zinc and the kinetics of their growth. V. Bugukov and D. Gluschkin (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 263—289).—From the kinetics of the growth of the γ phase at 300—600°, the diffusion coeff. obeys the law $D = Ae^{-Q/kT}$, both for solid solutions, and for the transformation from the liquid to the solid state of low-melting alloys. With Fe–Zn, the ϵ phase $FeZn_7$ and the γ phase Fe_3Zn_{10} were formed at 600° (a = 2·79 and 8·90 A., respectively). The Q vals. were ~15,200 for Cu–Zn and 17,700 for Fe–Zn. Ch. Abs. (*e*)

***X*-Ray analysis of crystal orientation in eutectic melts of zinc and cadmium.** D. M. Zagorodskitsch (*Tzvet. Met.*, 1935, **10**, No. 7, 114—120).—The unit cells of Cd and Zn in the eutectic single crystals possess definite orientation with respect to each other, the relative positions being in the direction [100]. Ch. Abs. (*e*)

Irreversible transformations in solid solutions. J. B. Fridman (*J. Tech. Phys. U.S.S.R.*, 1936, **6**, 78—82).—In the binary alloys Fe–Ni

and Fe–Mn, hysteresis between the transformations $\gamma \rightarrow \alpha$ on cooling and $\alpha \rightarrow \gamma$ on heating is a linear function of concn. The effect ∝ the at. radius. For Fe–Cr–Ni and for carbides in 18–8 Cr–Ni steel, hysteresis depends similarly on concn. By the simultaneous action of temp. and deformation, hysteresis is decreased 17—25%. The absence of the $\gamma \rightarrow \alpha$ transformation of austenite steels at >150° is due to hysteresis. CH. ABS. (*e*)

Diffusion of elements in iron. D. A. Prokoschkin (*Metallurg*, 1936, **11**, No. 1, 35—45).—If diffusion occurs at a temp. interval in which an increase of the diffusing element in the Fe causes the phase change $\alpha \rightleftharpoons \gamma$, there will be a sharp drop in the concn. of the diffusing element in passing from the γ to the α layer. If at the diffusion temp. the field of solid solutions is continuous, the concn. of the diffusing element will decrease uniformly with distance. CH. ABS. (*e*)

Alloys of the system Fe–C–Ti. I. S. Gaev (*Rep. Centr. Inst. Met. Leningrad*, 1935, No. 18, 68—93).—The alloys had C 0·08—2·70 and Ti 0·1—4·47%. The carbides are stable, take no part in the transformation process under heat-treatment, and prevent the enlargement of crystals of the solid solution in steels having no $\alpha \rightleftharpoons \gamma$ changes. TiC in hypereutectoid steel prevents formation of cementite needles during overheating. Ti is very active in closing the γ field. CH. ABS. (*e*)

Solubility of gases in organic solvents. I. Nitric oxide in methyl alcohol. L. Riccoboni (*Gazzetta*, 1941, **71**, 139—153; cf. Klemenc *et al.*, A., 1929, 1375).—The solubility of highly purified NO in MeOH is determined (apparatus described) at 0°, 10°, 20°, and 30°. As temp. increases, the Ostwald solubility coeff. decreases slightly. E. W. W.

Raman effect in partially miscible liquid systems. (Mrs.) Sree (*J. Mysore Univ.*, 1942, **B**, **2**, 105—107).—If two partly miscible liquids are shaken together and the Raman spectra of the two phases are studied simultaneously, it is possible to obtain the solubility of one liquid in the other. The Raman spectra of both phases are photographed at the same time, and the intensities of the Raman lines of each liquid in the light scattered by each phase give a measure of their mutual solubility. Pairs of liquids investigated in this way were MeOH–CS_2, H_2O–CCl_4, H_2O–CS_2, H_2O–BuOH, and CS_2–, CCl_4–, and C_6H_6–glycerol. A. J. M.

Hydrocarbon–water solubilities at elevated temperatures and pressures. J. Griswold and J. E. Kasch (*Ind. Eng. Chem.*, 1942, **34**, 804—806).—The solubilities in H_2O of three petroleum fractions (mean mol. wt. 147, 173, and 425, respectively) have been determined at 0—280°. The results expressed in mol.-% are independent of the mol. wt. of the oil, and permit the prediction of the solubility of H_2O in petroleum fractions for any steam pressure at temp. >300°. The solubility of petroleum in H_2O is ≪ that of H_2O in the oil and at const. temp. decreases with increasing mean mol. wt. The solubility of aromatic hydrocarbons is > that of petroleum fractions of equal mol. wt. J. W. S.

Effect of water on the solidification points of fatty acids. Solubility of water in fatty acids. C. W. Hoerr, W. O. Pool, and A. W. Ralston (*Oil and Soap*, 1942, **19**, 126—128).—The depression of the f.p. of the *n*-saturated fatty acids from C_6 to C_{18} has been investigated, and the solubility of H_2O in pure preps. of the C_6, C_7, C_{11}, C_{12}, C_{15}, and C_{18} acids at temp. from their f.p. to 100° determined experimentally; from the data, the approx. solubility of H_2O in the other acids has been computed. The solubility of H_2O decreases with the no. of C atoms in the fatty acid chain, with the exception of hexoic acid which dissolves less H_2O than heptoic acid; the temp. coeff. of solubility of H_2O also decreases as the series is ascended. E. I.

Solubilities of some chlorides and double chlorides in aqueous hydrochloric acid as a basis of separations. W. Seidel and W. Fischer (*Z. anorg. Chem.*, 1941, **247**, 367—383).—Data are presented for the solubility (*S*) of NaCl, KCl, NH_4Cl, $BeCl_2$, and $AlCl_3$ in aq. HCl of different concns. at 0°. With increasing [HCl] *S* for NaCl falls continuously and reaches 0·032% at 44·5% HCl, whilst for KCl and NH_4Cl *S* shows min. of 1·0 and 2·0 respectively at ~32% HCl. Continuous lowering of *S* is shown by both $BeCl_2$ and $AlCl_3$, but whilst $BeCl_2$ remains fairly sol. at the highest [HCl], *S* for $AlCl_3$ falls to 0·8 mg. Al per 100 c.c. in 44·3% HCl. Separation of Al from Be is almost as complete in aq. HCl as in Et_2O–aq. HCl (cf. A., 1942, I, 307). The *S* of $(NH_4)_2SnCl_6$ and of $(NH_4)_2TiCl_6$ (composition established by analysis) in saturated aq. HCl at 0° falls with increasing [NH_4Cl] to vals. corresponding with 0·4 mg. of Sn and 0·5 mg. of Ti per 100 c.c. at 4% NH_4Cl. In this form Sn can be sharply separated from Pb, and Ti from H_3PO_4, H_2SO_4, tartaric acid, and Be. Cu^{II}, Sb^{III}, and Sb^{V} are co-pptd. with $(NH_4)_2SnCl_6$, and V^{IV}, Fe^{II}, and Fe^{III} with $(NH_4)_2TiCl_6$. F. L. U.

Barium sulphide. Products of its decomposition, analytical methods and solubility. H. Solubility. C. Chorower (*Anal. Fis. Quim.*, 1941, **37**, 490—544; cf. A., 1942, I, 340).—The solubility of BaS in H_2O has been determined between 0° and 103°, when decomp. occurs. The solubility is represented by $3·4 + 0·13\theta + 0·004\theta^2$ in the range 0—90°; at higher temp. there is a fall in solubility. Comparison is made with the solubility of BaO, which exhibits a discontinuity at 70°. F. R. G.

Solubility of silver chloride in hydrochloric acid.—See A., 1942, I, 366.

Solubility of silver acetate in aqueous solutions.—See A., 1942, I, 366.

Solubility of salts and salt mixtures at temperatures above 100°. IV. A. Benrath (*Z. anorg. Chem.*, 1942, **249**, 245—250).—Solubility data are recorded for the substances and temp. ranges shown: $Na_2B_4O_7$, 108—140°; $Na_2S_2O_3$, 111—179°; H_3BO_3, 110—181°; sucrose, 107—144°; succinic acid, 108—160°; N_2H_4,H_2SO_4, 94—216°; $UO_2(NO_3)_2$, 80—187°; $Sr(NO_3)_2$, 179—475°; Na_2CrO_4, 140—372°; $K_2C_2O_4$, 130—330°; KHC_2O_4, 116—150°; $(NH_4)_2C_2O_4$, 114—195°. The solid phases are anhyd. over these ranges with the following exceptions: $Na_2B_4O_7,5H_2O$ is stable up to a congruent m.p. at 140°; the solid phase for $UO_2(NO_3)_2$ from 58·6° upwards is a lower hydrate, possibly the trihydrate; $K_2C_2O_4$ undergoes a transition at 177°, probably from monohydrate to anhyd. salt. F. J. G.

Solubility in the system Na_2CO_3–Na_3PO_4–H_2O at 25°. D. M. Korf and A. M. Baliasnaja (*J. Appl. Chem. Russ.*, 1941, **14**, 475—477).—The solution simultaneously saturated with $Na_3PO_4,12H_2O$ and $Na_2CO_3,10H_2O$ contains Na_3PO_4 6·4, Na_2CO_3 19·3, and H_2O 74·3%. J. J. B.

Adsorption isotherms and the law of mass action. (A) G. M. Schwab. (B) H. Dunken (*Z. physikal. Chem.*, 1940, **A**, **187**, 313, 314).—(A) The fact that the usual kinetic derivation of Langmuir's isotherm is almost identical with the derivation of the mass action law, as shown by Dunken (A., 1942, I, 19), had been demonstrated previously by several biochemists.
(B) A reply. J. W. S.

Adsorption of gases from lowest to highest pressures. II. Derivation and discussion of equations for ideal adsorption. A. von Antropoff (*Kolloid-Z.*, 1942, **99**, 35—52; cf. A., 1940, I, 208).—Theoretical. Equations for abs. and differential adsorption as functions of density and pressure have been developed. C. R. H.

Basis of the separation methods employing surface effects. J. Palacios and R. Salcedo (*Anal. Fis. Quim.*, 1941, **37**, 167—176).—The Freundlich equation $\gamma_0 - \gamma = Ac^{1/b}$ connecting surface tension with the concn. of absorbed particles *c* can be derived from Gibbs' equation if it is admitted that the association of the mols. in solution is *b* times that in the surface layer. F. R. G.

Time of collapse of spherical soap bubbles. S. Venkatesha (*J. Mysore Univ.*, 1942, **B**, **3**, 13—17).—The time of collapse of spherical soap bubbles depends on the η of the moist gas in the bubble, the surface tension of the solution, the initial radius of the bubble, and the diameter of the tube on which the bubble is blown. Experimental results agree with a formula given. A. J. M.

Surface energy relations in liquid–solid systems. I. Adhesion of liquids to solids and a new method of determining the surface tension of liquids. G. Macdougall and C. Ockrent (*Proc. Roy. Soc.*, 1942, **A**, **180**, 151—173).—A new method of measuring the surface tension of liquids is described. It consists of measuring the advancing and receding angles of contact of a liquid drop lying on an inclined plane surface. Accurate measurement of the angles is secured by optical projection of an enlarged image of the drop on a screen. The method is applied to a variety of solid–liquid systems and the results are in agreement with accepted vals. The advancing and receding contact angles are characteristic consts. of liquid–solid systems and the calc. and measured vals. of the min. receding angle are in agreement. The difference between the adhesions corresponding with the advancing and receding angles is ascribed to the work done in removing an adsorbed layer. It is suggested that the method may be useful in investigating the structure of monofilms and built-up layers of monofilms. G. D. P.

Relations between the spreading pressure, adsorption, and wetting. H. H. Rowley and W. B. Innes (*J. Physical Chem.*, 1942, **46**, 694—705).—Theoretical. The thermodynamic treatment of multilayers is discussed. The spreading pressure due to layers other than the first is subdivided into cases where the pressure is < and > saturation, and vals. for the spreading pressure of the first layer, when equilibrium exists between all the phases, have been calc. for several org. compounds adsorbed on C. The relation between contact angle and the reversible work of wetting a solid or an adsorbed layer is discussed. C. R. H.

Stability of multimolecular films of hydrocarbon oils, containing spreaders, on water surfaces. E. Heymann and A. Yoffe (*Trans. Faraday Soc.*, 1942, **38**, 408—417).—Although many spreading agents can reduce the val. of $\gamma_{\text{oil-H}_2O}$, the oil–H_2O interfacial tension, to an extent that permits the spreading coeff. F_s to assume positive vals., multimol. films of hydrocarbon oils on H_2O obtained by their use usually become unstable in time, owing chiefly to migration of spreader mols. from the oil–H_2O to the air–H_2O interface. These processes have been observed in experiments with paraffin oil, Nujol, and kerosene containing spreaders, the various tensions being

measured at the beginning and end of the experiments, and the extent of the oil film being estimated from the rate of evaporation of H_2O. With all the simple amphipathic substances used (fatty acids, alcohols, etc.) the film, initially 5—10 μ. thick, gradually contracted to a lens surrounded by a unimol. layer. Polymerised substances (stand oil, polyricinoleic acid, etc.) give rise to films which may be stable for many months. In all such films the interfacial layer is rigid, and the final vals. of F_s are usually negative, so that the films are thermodynamically metastable. Stable thick films can also be obtained by the use of certain dyes (Me-violet, malachite-green, methylene-blue) that cause a large reduction in $\gamma_{oil\text{-}H_2O}$ but have little influence on γ_{H_2O}. F. L. U.

Membrane equilibria. N. Barbulescu (*Kolloid-Z.*, 1942, **99**, 78—85).—Theoretical. Donnan's membrane equilibrium law is criticised as being only a special case of a more general law. General relations governing many types of membrane equilibria are derived. C. R. H.

Electro-optical properties of colloids. H. Müeller and B. W. Sakmann (*J. Opt. Soc. Amer.*, 1942, **32**, 309—317).—The photoelectric method described has been employed in a study of anomalous electric and magnetic birefringence in bentonite and mosaic virus sols. L. J. J.

New methods for the determination of stoicheiological quantities in colloidal systems. E. M. Galvez Laguarta (*Anal. Fis. Quim.*, 1941, **37**, 227—231).—The micelle concn. and size can be determined by the rate of flow and a method of Brownian compensation respectively. No details of the procedure are recorded. F. R. G.

Viscometric estimation of particle dimensions. I. System stearic acid–carbon tetrachloride. J. P. Hollihan and D. R. Briggs (*J. Physical Chem.*, 1942, **46**, 685—693).—η data for stearic acid (I)–CCl_4 solutions substantially confirm published data provided the data are handled according to the Sakurada procedure. This procedure is critically examined, and it is shown that particle-shape data obtained by its use may be mathematical artifacts. Over the flow rates studied the (I) particles are spherical. C. R. H.

Lange reaction. New reducing agent in the preparation of aurosol. L. S. V. de Bollini (*Rev. Fac. Cienc. Quim., La Plata*, 1941, **16**, 103—108).—The use of arabinose as a reducing agent in the prep. of aurosol is described. F. R. G.

Electron-microscopic observations on zinc-black. J. Gundermann and H. Külz (*Kolloid-Z.*, 1942, **98**, 287—289).—Zn-black (I), prepared by evaporation of Zn metal at 0·3—2 Torr., when examined in the ultramicroscope, was observed to consist of single, clearly-defined hexagonal Zn crystals, which varied in size from 0·1 to 1 μ. These observations were confirmed when (I) was examined in the electron microscope. In the first photograph the crystals were completely opaque, in the second some were transparent, and in a third many were transparent. This increase in transparency may be due to volatilisation of Zn by the electronic irradiation, the ZnO formed as a surface coating being thus left behind as transparent hexagonal skins. N. G.

Colloidal carbon as revealed by the electron microscope.—See B., 1942, I, 402.

(A) Dispersion of aqueous graphite suspensions and the effect thereon of the addition of sodium hydroxide. V. S. Veselovski. **(B) Stabilisation of graphite suspensions by means of tannin in increasing concentration. Stabilisation isotherms and the method of their determination.** E. V. Chalapsina. **(C) Stabilisation effect of tannin on suspensions of different kinds of graphite at different p_H values of the dispersion medium.** N. N. Serb-Serbina. **(D) Stabilisation of graphite suspensions in non-aqueous dispersion media (hydrocarbons) by polar substances.** E. K. Venström and E. M. Svereva. **(E) Stabilising power of surface-active substances (protective colloids) and especially of alizarin-red.** P. A. Rehbinder and N. N. Serb-Serbina (*Issledov. Fiz.-Chim. tech. Suspensii*, 83—90, 91—101, 102—116, 117—130, 131—143).—(A) When the dispersion medium is gradually displaced by pure H_2O (by washing) a stabilisation max. is observed. With further washing the degree of dispersion decreases, owing to autocoagulation. The ash content and condition of oxidation of the graphite influence the results.

(B) Increase in tannin concn. from 0 to 0·07% in a 5% graphite suspension in 0·1N-NaOH produces marked stabilisation. The most probable size falls from 75 to 37 μ. Further additions up to 0·5% increase the stability only slightly.

(C) In absence of tannin, the max. dispersion is in 10^{-4}N-NaOH. For graphite oxidised with H_2CrO_4, considerably greater stability is observed during washing than during the reverse process of adding NaOH. For oxidised Aliberov graphite the reverse is true.

(D) Fatty acids, alcohols, amines, and phenols act as stabilisers for graphite suspensions in C_6H_6 and in C_6H_6 mixed with other hydrocarbons.

(E) The action of alizarin-red as an emulsifier for C_6H_6 and Hg in relation to p_H, its surface activity on the liquid boundary surface, the adsorption on graphite, and the stabilising action on aq. graphite suspensions were investigated. Ch. Abs. (e)

Colloidal properties of aqueous dispersions of titanium dioxide.—See B., 1942, I, 416.

Ageing and coprecipitation. XXXVI. Mixed-crystal formation of lead molybdate with colloidal and flocculated lead chromate. I. M. Kolthoff and F. T. Eggertsen (*J. Physical Chem.*, 1942, **46**, 616—620).—When colloidal $PbCrO_4$ is shaken with a solution of Na_2MoO_4 only surface exchange occurs, interaction not taking place until the $PbCrO_4$ has been flocculated. This behaviour contrasts with that of colloidal AgBr and is typical of colloidal solutions of particles that are not subject to thermal ageing at room temp. C. R. H.

Influence of chemical structure on the imbibition of liquids by rubber. I. G. S. Whitby, A. B. A. Evans, and D. S. Pasternack (*Trans. Faraday Soc.*, 1942, **38**, 269—275).—Measurements are recorded of the swelling of raw and of vulcanised rubber in a large no. of org. liquids representative of hydrocarbons, alcohols, chlorohydrins, aldehydes, ketones, nitriles, acids, acid anhydrides, acid chlorides, NO_2-compounds, and S compounds. In no liquid is a sharp max. of imbibition observed within 1 month; in some the increase is slight, in others large, after 24 hr. Polar groups are unfavourable to swelling, more so in aliphatic than in aromatic compounds; the largest inhibitory effect is shown by OH. Swelling is increased by unsaturation. In a strictly homologous series swelling is usually in the order of decreasing dielectric const., but is not quantitatively related to it; among compounds of different classes the dielectric const. is not a trustworthy guide. F. L. U.

Interaction between rubber and liquids. II. Thermodynamical basis of the swelling and dissolution of rubber. III. Swelling of vulcanised rubber in various liquids. G. Gee (*Trans. Faraday Soc.*, 1942, **38**, 276—282, 418—422; cf. A., 1942, I, 204).—II. Approx. formulæ are derived for the relation between the Gibbs free energies of dissolution and dilution and the temp. and vol. fraction of rubber in its mixtures with org. liquids. Temp. coeffs. of solubility of the right order of magnitude are thus calc. In the fractional pptn. or dissolution of mixed rubbers it is shown that (1) the efficiency of separation should be greatly improved by the use of dil. solutions, and (2) no single-stage fractionation can give even an approx. complete separation between rubbers of mol. wt. differing by a factor <2.

III. An expression is derived giving an approx. relation between the swelling power of a liquid and its mol. vol. and cohesive energy. The calc. swelling of vulcanised rubber in various org. liquids agrees substantially with experimental data (cf. preceding abstract), provided the formulæ used have different numerical consts. for aliphatic and aromatic liquids. A val. of 66 g.-cal. per c.c. is deduced for the cohesive energy density of rubber. F. L. U.

Kinetics of rubber-like elasticity. D. D. Eley (*Trans. Faraday Soc.*, 1942, **38**, 299—305).—Relaxation phenomena in polymerides are discussed with special reference to their treatment by Kuhn (A., 1939, I, 192) and Alexandrov and Lazurkin (A., 1941, I, 112). In rubber, the movement of segments (~10 isoprene units) is held to occur without appreciable internal rotation, but to be accompanied by a high degree of rotation during activation in elastic orientation. F. L. U.

Kinetics of high elasticity in synthetic polymerides. R. F. Tuckett (*Trans. Faraday Soc.*, 1942, **38**, 310—316).—The Mark–Kuhn theory of high elasticity in rubber has been extended to include the elastic properties of other polymerides. It is assumed that high elasticity is developed only when rotation of the main C–C chain is relatively free. The influence of mol. structure, plasticiser, and cross-linkings is discussed. F. L. U.

Permeability in relation to viscosity and structure of rubber. R. M. Barrer (*Trans. Faraday Soc.*, 1942, **38**, 322—330; cf. A., 1939, I, 317; 1940, I. 292).—A discussion of the statistics of activated zones in rubber shows that functional relationships should exist between the Arrhenius energy of activation for diffusion or viscous flow and log (diffusion coeff. for simple solutes), log viscosity, and entropy of activation. Available data confirm this prediction and show further that there is no discontinuity between rubber and liquids as diffusion media. F. L. U.

Stereochemistry of the rubber molecule. C. W. Bunn (*Trans. Faraday Soc.*, 1942, **38**, 372—376).—The influence of geometrical factors on the internal rotation and the m.p. of rubber is discussed. F. L. U.

Long spacing in rubber. A. Schallamach (*Trans. Faraday Soc.*, 1942, **38**, 376—380).—The long spacing found in the *X*-ray diagram of some rubbers is shown to be due to $COMe_2$-sol. impurities, which probably occur in flake-shaped crystals. Orientation effects of these crystals in deformed rubber are discussed. F. L. U.

Conductances of solutions of several alkyl sulphates and sulphosuccinates. F. D. Haffner, G. A. Piccione, and C. Rosenblum (*J. Physical Chem.*, 1942, **46**, 662—670).—Equiv. conductivities (A) of several Na alkyl sulphates and sulphosuccinates show that aggregation occurs with the latter just as with the former. Crit. concns. for micelle formation and Λ_∞ vals. have been evaluated. C. R. H.

Macromolecular compounds. CCLXXVIII, CCLXXIX. Heteropolar molecular colloids. III. Polymeric amines as an albumin model. IV. Polymeric amine salts and polyethyleneimines. W. Kern and E. Brenneisen (*J. pr. Chem.*, 1941, [ii], **159**, 193—218, 219—240).—III. Polymeric amines have been prepared by thermal condensation of *NN'*-tetramethyldiamines with $Br\cdot[CH_2]_n\cdot Br$ (n = 3, 5, 10) at 20—100°, and by the polymerisation of $(CH_2)_2NH$ with acid catalysts (40—66% HBr best). Kinetic data show that the polymerisation reaction is of the second order. Several polyethyleneimine derivatives have been prepared.

IV. Osmotic, conductivity, and η data for aq. solutions of polymeric amine salts and polyethyleneimines are recorded. C. R. H.

Spherical nature of starch granules. A. Wieler (*Kolloid-Z.*, 1942, **99**, 95—98).—Discussion. C. R. H.

Relation of the concentration of starch suspensions to their viscosity. W. C. Davison (*J. Biol. Chem.*, 1942, **144**, 419—422).—Aq. suspensions of sol. starch made by successive dilution show a direct relation between concn. and sp. fluidity, whereas those made up by direct weighing do not. The discrepancy is attributed to the presence of visible granules which do not contribute to the viscosity, and occur in varying proportions in freshly made suspensions, but remain const. in dilutions from a single suspension. R. L. E.

Mol. wt. determinations by precipitation of hydrolytically degraded glycogens. E. Husemann (*J. pr. Chem.*, 1941, [ii], **158**, 163—175).—A series of ten degradation products of glycogen was prepared by progressive hydrolysis with 2N-HCl, and a middle fraction (by pptn. with MeOH) of each product, dissolved in 0·1N-$CaCl_2$, was used for osmotic pressure measurements. The calc. mol. wts. of the products varied from 20,300 to 1,530,000, showing degrees of polymerisation P of 125—9500. Measurements of η with 1% solutions in 0·1N-$CaCl_2$ at 20° gave a const. val. for $\eta_{sp}s/c$ = 0·012±0·001, confirming the Einstein equation, the higher val. of $\eta_{sp}s/c$ (theoretical val. 0·0025) probably being due to solvation. Titration of aq. solutions of the degradation products with MeOH at 25° and 35° to the turbidity point (results reproducible to ±1%) did not give a straight line for no. of ml. MeOH against mol. wt.; a straight line was obtained by plotting γ^* (vol. fraction of MeOH at turbidity point) against $1/P^{\frac{1}{2}}$ or $1/P^{\frac{2}{3}}$ (but not $1/P$), thus showing the applicability of the Schulz and Jirgenson equation $\gamma^* = \alpha + \beta/P^m$ where m = 1 for linear mols. and $\frac{2}{3}$ for spherical mols. Decrease in the concn. of the solutions from 1 to 0·0313% gave a decrease in the val. of γ^* of ~15%. The vals. of P calc. by this method differed from those derived from osmotic pressure measurements by 0—10%.

J. L. E.

Ideal and mathematical treatment of particle size degradation in cellulose. A. Matthes (*Kolloid-Z.*, 1942, **98**, 319—329).—The degree of division (S) ("Spaltungsgrad") is defined as $1/P$, where P is the degree of polymerisation of a macromol. material; S can then be used to characterise the particle size distribution. The uses of this concept are outlined, and with its aid the kinetics of a no. of depolymerisation reactions is considered mathematically. It is shown that, when pairs from six cellulose fractions are mixed in equal proportions, P (from η measurements) of the resulting mixture is near the arithmetic means of the P vals. of the two components, but is different from the P val. calc. on the basis of the actual particles present. The deviation is greatest where the constituents show the greatest difference in P vals. The variation of the function $P_{visc.}/P_{osm.}$ is given for the depolymerisation of cellulose from P = 2000 to P = 1. N. G.

Influence of the milling process on the properties of high polymers (cellulose and polystyrene) and the nature of the milling process. II. K. Hess, E. Steurer, and H. Fromm (*Kolloid-Z.*, 1942, **98**, 290—304).—The mathematical consideration of the action of a swing mill is continued (*ibid.*, 148). It is deduced that for cellulose (I) the average no. of C–O or C–C bonds broken per collision is ~4×10^{10}; of the total energy given out per collision, only ~0·013% is used in causing mol. breakdown, the rest being employed in elastic deformation of the balls, the mill walls, and the material being ground (when it reappears as heat), and in breaking down the van der Waals forces in (I). The no. of bonds broken per collision may be increased by the presence of finely ground material from the mill and/or the balls. The electron microscope showed torn fibres to consist of bundles of "primary" fibrils ~150 A. thick. The breakdown of polystyrene (II) is accompanied by a rapid fall in the η of solutions, as had previously been found for (I). The η of the solutions of ground (II) in C_6H_6 is the same whether it is ground at 20°, 40°, or 60°. The mol. breakdown of (II) by grinding is confirmed by osmotic pressure measurements; its rate is the same as for (I). For both (I) and (II) the mol. breakdown is probably not due to hydrolysis, oxidation, or thermal decomp., but to the stresses and strains set up during the collisions. It is concluded that the grinding process consists in a direct conversion of the collision energy of the balls into mol. vibrational energy in the material being ground, which then undergoes mol. scission. N. G.

Rheometry and colloidal properties of the system sodium cellulose-glycollate–water. F. Höppler (*Kolloid-Z.*, 1942, **98**, 348—358).—The rheo-viscometer (described) is used to determine the rheological properties of aq. sols and gels of Na celluloseglycollate (H_2O-sol. cellulose) (I). Even at low concns., the sols of (I) possess structural viscosity, so that Staudinger's rule is not observed. Thixotropy is absent. With more viscous samples, both rheopexy and "rheodestruction" (irreversible mechanical breakdown of the gel structure by flow processes) are observed when successive flow times are determined on 2% and 4% sols. Photomicrographs taken before and after treatment of the sols in the viscometer confirm the rheodestruction deduced from η measurements. When the ultrafilterable part of (I) sols is dried to a film, the latter gives the same X-ray diffraction pattern as (I). It is concluded from this that aq. suspensions of (I) contain the reversible system xerogel ⇌ lyogel ⇌ lyosol, the equilibrium positions depending on the concn. The interaction between Na-cellulose and $CH_2Cl\cdot CO_2Na$ is considered to take place first in the amorphous region of the cellulose threads, then on the surface of the crystallites, and finally inside the crystallites. Microscopically, (I) made from pinewood material is not distinguishable from the latter. Photomicrographs of (I) are given for each stage of the swelling process and the mechanism of the swelling process is discussed. N. G.

Solubility state of high polymers. I. Activity of solvents towards cellulose acetates, nitrates, and aceto-nitrates. M. Takei (*Kolloid-Z.*, 1942, **98**, 312—318).—The solubility of cellulose acetate (I), nitrate (II), and aceto-nitrate (III) was investigated with reference to the dipole moment (μ), the dielectric const. (ϵ), and the surface tension (γ) of the solvent, by determining the val. of $a = \mu^2/\epsilon\gamma$ (cf. A., 1942, I, 144) for 63 solvents. (I) is sol. in solvents possessing relatively low vals. of a, and (II) in solvents having relatively large vals. of a. (III) behaves in an intermediate fashion, approximating to (I) or (II) according to the relative proportions of Ac or NO_2 groups present. N. G.

Extension and rupture of cellulose acetate and celluloid. R. N. Haward (*Trans. Faraday Soc.*, 1942, **38**, 394—403).—Measurements of the extension and rupture of cellulose acetate and celluloid at 26° indicate that the two processes are largely independent. Superposed on a time-independent extension obeying Hooke's law is a much larger slow extension, which is elastic in the sense that recovery is complete on raising the temp. to 65—70°. Weakening of the material accompanies extension, and subsequent extensions (after recovery) are more rapid, and the breaking time is shorter, for the same load. Equations relating stress, strain, and time are derived. F. L. U.

Thermodynamics of high polymer solutions. P. J. Flory (*J. Chem. Physics*, 1942, **10**, 51—61).—By a statistical-mechanical treatment of high polymeride solutions the entropy of mixing n solvent and N linear polymeride mols. has been derived. The entropy of disorientation of a perfectly arranged linear polymeride is ~R g.-cal. per chain segment. Partial molal free energies have been computed and phase equilibria have been calc. in the region of partial miscibility. Theoretical and observed vals. are compared. W. R. A.

Viscosity and mol. wt. of high polymers. H. Staudinger (*Kolloid-Z.*, 1942, **98**, 330—332).—Reply to Meyer (cf. A., 1942, I, 237). N. G.

Mol. wt. determinations on macromolecular substances. IX. Equation lor the calculation of the viscosity number at very small concentrations. G. V. Schulz and F. Blaschke (*J. pr. Chem.*, 1941, [ii], **158**, 130—135).—The viscosity no. of a solution, η_{sp}/c, where $\eta_{sp} = (\eta_1 - \eta_0)/\eta_0$, η_1 being the sp. viscosity of the solution and η_0 that of the solvent, approaches a const. val. only at very low concns., as expressed in the Staudinger equation $\eta_{sp}/c = K_mP$ where P is the degree of polymerisation. For the η of solutions of various concns. of both fractionated and unfractionated poly-Me methacrylate, determined in $CHCl_3$, the limit of η_{sp}/c as c approaches zero is a const. for each sample. Given the val. of $(\eta_{sp}/c)/(1 + K_n\eta_{sp})$, where K_n is a const. depending on the substance, the val. of K_n may be found from the linear plot of η_{sp}/c against η_{sp}; a typical series of curves is given. J. L. E.

Calculation of the limiting value $\lim_{c\to 0}(\eta_{sp}/c)$. (A) H. L. Bredée. (B) G. V. Schulz and F. Blaschke (*J. pr. Chem.*, 1941, [ii], **159**, 146—152, 153—154).—(A) The η–concn. formula of Schulz and Blaschke (cf. preceding abstract) is shown to be the well-known equation of Fikentscher and Mark in another form. The importance of Bredée's η formula and his idea of "voluminosity at infinite dilution" (cf. A., 1937, I, 303) is stressed.

(B) A reply to the above. C. R. H.

Mol. wt. determinations on a series of methyl polymethacrylates by different methods (osmotic, viscometric, and by precipitation-titration). G. V. Schulz and A. Dinglinger (*J. pr. Chem.*, 1941, [ii], **158**, 136—162).—The mol. wts. of poly-Me methacrylate fractions obtained by fractional pptn. of C_6H_6 solutions with *cyclo*hexane were calc. from osmotic pressure measurements carried out on their $COMe_2$ solutions, the equation $M = RTc/p[1 - c(k/p)^{1/v}]$ being used, where c = concn., p = osmotic pressure, and k and v are const. for the whole series of polymerides in the given solvent; the mol. wts. thus found vary from 13,350 to 650,000. p/c–c curves for various

fractions at 27° are reproduced. Vals. of K_m in the Staudinger equation, calc. from measurements of η_{sp} in $CHCl_3$, were not const., but became nearly const. when K_m was replaced by $A + B/P$, where the consts. A and B are $0{\cdot}47 \times 10^{-4}$ and 95×10^{-4}, respectively, and P is the degree of polymerisation. P was determined for polymeride fractions with mol. wts. up to 100,000 by pptg. their C_6H_6 solutions with *cyclo*hexane and using the equation $\gamma^* = \alpha + \beta/P$, where γ^* is the content of precipitant at the turbidity point and α and β are consts. The vals. of P so obtained agree with those determined from osmotic pressure data. The viscometric method is valid for both fractionated and unfractionated poly-Me methacrylates with mol. wts. from 15,000 to 900,000; the results indicate that this mol. is linear or only slightly branched. J. L. E.

Physicochemical properties of gelatin fractions. L. N. Putilova (*Kolloid. Shurn.*, 1935, **1**, 49—55).—Fractionation by means of H_2O at 22° give micellar wts. ranging from 26,000 to 98,000 and heats of swelling from 0·2 to 30 g.-cal. per g. The mol. wts. of the chains bound by principal valency bonds vary from 1400 to 1600. Various fractions are due, not to keto-enol tautomerism, but to an NH_2-acid–internal NH_4 salt isomerism. CH. ABS. (*e*)

Viscosity measurements during the coagulation and gelation of concentrated sols of zirconium and stannic hydroxides. M. Prasad and K. V. Modak (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 445—455).—Addition of electrolytes to extremely dialysed $Sn(OH)_4$ sol produces gelation, whereas similar addition to $Zr(OH)_4$ sol, and to $Sn(OH)_4$ sols undialysed or dialysed for 12 days, produces coagulation. Changes in η during gelation and coagulation under a variety of conditions and coagulators have been measured; the η-time curves for both processes in the same sol show similar characteristics. Measurements of η do not yield information regarding the gelation process which occurs after primary coagulation. W. R. A.

Reversible aggregations of colloidal particles. II. Isothermal and reversible changes of absorption in thixotropic iron oxide sols. W. Heller and G. Quimfe (*J. Physical Chem.*, 1942, **46**, 765—777).—The reversible change in absorption which accompanies thixotropic sol–gel transformations in systems with strongly diffracting goethite crystals is explained by assuming the formation of two phases, a conc. phase of "geloids" and a dil. phase of primary particles. C. R. H.

Coagulation of lyophilic sols by means of organic substances and salts. VIII. B. Jirgensons (*Kolloid-Z.*, 1942, **99**, 89—95).—The influence of chlorides on the coagulation by alcohols and $COMe_2$ of deaminocasein (**I**), casein (**II**), and a (**II**) decomp. product (**III**) has been investigated. At low coagulant concns. (**I**) is less easily coagulated than (**II**), but increase in coagulant concn. tends to stabilise (**II**). (**III**) is less easily coagulated by PrOH + NaCl than (**II**). C. R. H.

Electrokinetic study of octadecyl alcohol. Comparison of mobility values obtained by electrophoresis and by electro-osmosis. A. J. Ham and H. W. Douglas (*Trans. Faraday Soc.*, 1942, **38**, 404—408).—Apparatus and procedure suitable for electro-osmotic experiments with substances lighter than H_2O are described (cf. A., 1942, I, 217). Measurements with octadecyl alcohol (**I**) in the p_H range 2—12 give vals. of the ζ-potential in numerical agreement with those obtained from electrophoresis, although the particles of (**I**) used in the latter were 100 times smaller in diameter than those used for electro-osmosis. Both methods give the same isoelectric point at a p_H between 2 and 3. F. L. U.

Potential in a solution near a charged wall. W. G. Eversole (*J. Chem. Physics*, 1942, **10**, 78).—An extension to salts of different valency types (cf. A., 1941, I, 413; 1942, I, 98). W. R. A.

Sensitisation and surface charge of lyophilic colloids. E. A. Hauser and M. R. Cines (*J. Physical Chem.*, 1942, **46**, 705—709).—There is a slight decrease in the coagulation val. of NaCl towards Fe_2O_3 sols on the addition of increasingly neutralised agar. This is the reverse of what would be expected were the surface charge of the agar effective in sensitising the sol. The data are discussed with reference to theories of sensitisation. C. R. H.

Electrokinetic equations for gels and the absolute magnitude of electrokinetic potentials. J. J. Bikerman (*J. Physical Chem.*, 1942, **46**, 724—730).—Membranes of swelling substances offer a greater resistance to liquid flow than to ionic migration. The significance of this is discussed with reference to electro-osmosis, streaming potential, and cataphoresis. C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Theory of binary systems. K. Fredenhagen and E. Tramitz (*Kolloid-Z.*, 1942, **99**, 52—73).—A general discussion on energy relations in homogeneous binary systems. C. R. H.

Equilibrium in the gas reaction, $CHBr_3 + Br_2 \rightleftharpoons CBr_4 + HBr$. J. W. Strong and R. N. Pease (*J. Chem. Physics*, 1942, **10**, 79—80).—Determinations of equilibrium in the reaction $CHBr_3 + Br_2 \rightleftharpoons CBr_4 + HBr$ indicate incomplete substitution in the gas phase as predicted by Stevenson and Beach (A., 1938, I, 185, 399). W. R. A.

Equilibrium of formaldehyde with glycine and alanine.—See A., 1942, **II**, 348.

Associating effect of the hydrogen atom. X. N-H–N bond. Constitution of the benztriazoles. T. G. Heafield and L. Hunter (*J.C.S.*, 1942, 420—422).—Cryoscopic measurements in $C_{10}H_8$ solution indicate that benztriazoles with a free NH group are strongly associated but that substitution of the H by aryl or acyl prevents association. It is considered that in the former H-bonds tend to link the 1- and 3-N atoms in separate mols., and to a smaller extent 1- and 2-N atoms. This behaviour is in accord with the tautomeric character of the compounds. J. W. S.

Hydration of unsaturated compounds. IX. Oxonium complex constant of mesityl oxide. X. Rôle of oxonium complexes in the hydration of mesityl oxide and the dehydration of diacetone alcohol. D. Pressman, L. Brewer, and H. J. Lucas (*J. Amer. Chem. Soc.*, 1942, **64**, 1117—1122, 1122—1128; cf. A., 1942, I, 371).—IX. The oxonium complex const. for mesityl oxide (**I**) (= mesO), viz., $K = [\text{mesO·H}^+]/[(\text{I})][H_3O^+]$, is determined at 25° by a distribution method to be 0·44 and 0·45 in aq. solutions of ionic strengths (μ) 2 and 1 respectively. The partition coeff. $[(\text{I})]_{CCl_4}/[(\text{I})]_{H_2O}$, 26·3 at 25° and 28·0 at 30°, is const. when $[(\text{I})]_{CCl_4} > 0{\cdot}2\text{M}$.; $CH_2Ac\text{·}CMe_2\text{·}OH$ (**II**) lowers the coeff. by 0·25% for each 0·01 mol./l. present in the aq. phase. Salting-out coeffs. of H_3O^+, ClO_4', NO_3', and Na^+ are determined for $\mu = 2$ and 1. The apparent heat of the reaction mesO + H_3O^+ = mesO·H$^+$ + H_2O in aq. solution is ~0; the heat of transference of (**I**) from N-salt solution to H_2O = 1·4 kg.-cal./mol.

X. (**I**) and mesO·H$^+$ become hydrated in aq. solution at 25°, and under the same conditions (**II**) and its oxonium salt become dehydrated. Each reaction is unimol. with respect to the org. reactant and to $[H_3O^+]$. By measuring the displacement of the equilibrium const. between (**I**) and (**II**) with varying $[H_3O^+]$ the oxonium complex const. $K_{(II)}$ is found to be 0·3 at 25°. Heat of hydration of (**I**) = 7·5±0·3 kg.-cal.; heat of activation = 12·8±0·15 kg.-cal. for the hydration of (**I**) and 20·4±0·3 kg.-cal. for the dehydration of (**II**). F. L. U.

Solubility of silver chloride in hydrochloric acid (complex salt formation). W. Erber and A. Schühly (*J. pr. Chem.*, 1941, [ii], **158**, 176—185).—With increase of concn. of aq. HCl between 11·8 and 23·7 mol.-% the solubility of AgCl steadily increases. Tables and solubility curves for 0° and 25° are given. The dissociation const. for $AgCl_4'''$ as given by $[a_{Ag^+} \times a_{Cl^-}{}^4]/[a_{(AgCl_4)'''}]$ for $[Cl'] = 4\text{M}$. is $1{\cdot}2 \times 10^{-6}$, the stability const. is $0{\cdot}8 \times 10^6$, and the free energy of formation (ΔF°) is 8 kg.-cal. The temp. coeffs. of solubility and heats of dissolution are calc. The heat of the reaction $Ag^+_{dissolved} + 4Cl^-_{dissolved} = AgCl_4'''_{dissolved}$ is 14 kg.-cal. per mol. J. L. E.

Solubility of silver acetate in aqueous solutions of some other acetates. Formation of diacetato-argentate ion. F. H. MacDougall and M. Allen (*J. Physical Chem.*, 1942, **46**, 730—737).—Solubility data at 25° for AgOAc in solutions of NaOAc, KOAc, $Ca(OAc)_2$, and $Sr(OAc)_2$ are recorded. The effect of added electrolytes on the solubility product of AgOAc is discussed, and the existence of $Ag(OAc)_2'$ is suggested to account for deviations from Debye's theory. The dissociation const. of $Ag(OAc)_2' = 0{\cdot}28 \pm 0{\cdot}05$. C. R. H.

Solubility of silver acetate in aqueous solutions of silver nitrate and of silver perchlorate. Complex ions formed from silver and acetate ions. F. H. MacDougall (*J. Physical Chem.*, 1942, **46**, 738—747).—Solubility data at 25° for AgOAc in solutions of $AgNO_3$ and $AgClO_4$ are recorded. Deviations from Debye's theory are explained as before (cf. preceding abstract) and on the additional assumption of the existence of Ag_2OAc^+, the dissociation const. of which is $0{\cdot}073 \pm 0{\cdot}007$. The comparative stability of Ag_2OAc^+ is probably due to appreciable resonance energy. C. R. H.

Diffusion and hydration of cupric and nickel ions in aqueous, acid, neutral, and ammoniacal solutions. G. Jander and H. Möhr (*Z. physikal. Chem.*, 1942, **A, 190**, 81—100).—The diffusion coeffs. of Cu and Ni in aq. $Cu(ClO_4)_2$, $CuCl_2$, $Ni(NO_3)_2$, and $NiCl_2$ remain const. over wide ranges of variation of foreign electrolyte concn. and p_H val. There is no tendency for Cu and Ni salts to associate with increasing degree of hydrolysis. In the presence of an excess of alkali metal sulphate, $CuSO_4$ and $NiSO_4$ show some complex ion formation, whilst $CuCl_2$ shows some evidence of the formation of ions of the type $CuCl_3'$ or $CuCl_4''$ in the presence of HCl or a readily sol. chloride. In aq. NH_3 Cu and Ni diffuse more rapidly than in neutral or acid solution and the diffusion coeff. is independent of concn. and of the nature of the anion, indicating the stability of the $Cu(NH_3)_4^{++}$ and $Ni(NH_3)_6^{++}$ ions. Diffusion measurements indicate that the Cu^{++} and Ni^{++} ions have 7—8 and ~10 mols. of H_2O of hydration, respectively. J. W. S.

Ionic concentration gradients and their biochemical significance. I, II. F. Almasy (*Helv. Chim. Acta*, 1941, **24**, 1025—1039, 1480—1495).—Systems in which there are steady ionic concn. gradients are discussed theoretically, with particular reference to systems containing polybasic acids, polyacid bases, and redox systems, such as reproduce the conditions present in living cells. J. W. S.

Ionisation in non-aqueous solvents. V. Formation of certain methoxides and ethoxides in methyl and in ethyl alcohol. W. L. German and T. W. Brandon (*J.C.S.*, 1942, 526—528).—EtOH and MeOH solutions of $AgNO_3$, $NiCl_2$, CdI_2, $CuCl_2$, $CoCl_2$, and $HgCl_2$ ppt. metallic ethoxides and methoxides when treated with NaOEt and NaOMe, respectively. C. R. H.

Strengths of the hypohalogenous acids. Treatment of simultaneous reactions. A. Skrabal (*Z. Elektrochem.*, 1942, **48**, 314—327, 448).—The work of Shilov (A., 1988, I, 196) on the dissociation consts. of HOCl and HOBr fails to allow for the formation of chlorate or bromate in the experimental solutions. Calculations from his results with allowance for the effects of the side reactions give the vals. $k = 3{\cdot}6 \times 10^{-8}$ for HOCl and 2×10^{-11} for HOBr at 25°. For HOI a val. $k = 5 \times 10^{-13}$ is estimated. F. J. G.

Basic dissociation constants and electrolyte action in glacial acetic acid. S. Kilpi and M. Puranen (*Z. physikal. Chem.*, 1940, **A, 187**, 276—284).—The basic dissociation const. of *o*-$NH_2{\cdot}C_6H_4{\cdot}CO_2H$ (I) in pure AcOH has been determined with and without the presence of $LiClO_4$ as neutral salt. The results can be expressed by the Debye–Hückel equation if the ionic diameter is taken as 8·1 A. and ϵ as 6·13. At 20° the thermodynamic dissociation const. of (I) in pure AcOH is $3{\cdot}5 \times 10^{-7}$. J. W. S.

Theory of the isoelectric point. III. T. L. Hill (*J. Physical Chem.*, 1942, **46**, 621—624).—The theory of the isoelectric point when developed by the exclusive use of activities leads to the same conclusions as in earlier papers (cf. A., 1942, I, 328). C. R. H.

Buffer capacity. L. F. Beste (*J. Chem. Educ.*, 1942, **19**, 296; cf. A., 1942, I, 328). L. S. T.

Methane–*iso*butane system. R. H. Olds, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1942, **34**, 1008—1013).—Data for the vol. and phase behaviours of the system CH_4–*iso*-C_4H_{10} at pressures up to 5000 lb. per sq. in. and over the range 38—328° are recorded in tabular and graphical form. C. R. H.

Ethylene–ethane and propylene–propane equilibria. G. B. Kistiakowsky (*J. Chem. Physics*, 1942, **10**, 78—79, 146).—The thermal equilibrium consts. in $C_2H_6 = C_2H_4 + H_2$ have been determined at 380° and 450° and those in $C_3H_8 = C_3H_6 + H_2$ at 310° and 375°. Equilibrium was approached from both sides using an aged Cr_2O_3 catalyst. Heats of reaction calc. from the van't Hoff isochore agree with vals. extrapolated from C_p date. Vals. of K_p calc. statistically from heats of reaction and mol. consts. agree satisfactorily with those from thermal equilibrium. This substantiates the view that C_3H_6 has a potential barrier of ~2100 g.-cal. W. R. A.

Vapour–liquid equilibrium data on ethyl alcohol–water and on *iso*propyl alcohol–water. W. M. Langdon and D. B. Keyes (*Ind. Eng. Chem.*, 1942, **34**, 938—942).—New data for both systems have been obtained with accuracies of 0·2 ($Pr^{\beta}OH$) and 0·05 (EtOH) mol.-%. The azeotrope of $Pr^{\beta}OH$–H_2O contains $68{\cdot}35 \pm 0{\cdot}03$ mol.-% of $Pr^{\beta}OH$. C. R. H.

Phase behaviour in the methane–propane–*n*-pentane system. R. H. Dourson, B. H. Sage, and W. N. Lacey (*Amer. Inst. Min. Met. Eng.*, 1942, *Tech. Publ.* 1490, 10 pp.).—The compositions of the co-existing phases in the above system were determined at 160° and 220° F., for pressures of 500—2000 lb. per sq. in. The gas–liquid equilibrium consts. (e) for the components of the system were calc. The product of pressure (p) and e for CH_4 is plotted as a function of p for various vals. of the parameter $C = X_1/(X_1 + X_2)$ where X_1 is the mol. fraction of C_3H_8 in the liquid phase, and X_2 is that of C_5H_{12}. There is a regular decrease of e of CH_4 with increase in C. In the case of C_2H_6, there is a progressive increase in e with increase of C. The product of e and p increases with rise of temp. for both C_3H_8 and C_5H_{12}. A. J. M.

Heat of formation of several mineral carbonates. W. A. Roth (*Z. pr. Chem.*, 1941, [ii], **158**, 117—124).—The heats of formation of cerussite (100% $PbCO_3$), witherite (99·4% $BaCO_3$), and magnesite (pure $MgCO_3$) have been determined at const. pressure and ~20°. Those of cerussite and witherite have been found by measuring the heats of dissolution of the corresponding oxides and carbonates in HNO_3 solutions, corrections being made for the heats of evaporation and dilution of the solutions used; the heat of formation of $PbCO_3$ from yellow PbO and gaseous CO_2 is $18{\cdot}91 \pm 0{\cdot}11$ kg.-cal. per mol., and of $BaCO_3$ is 61 kg.-cal. per mol. The heat of formation of magnesite from MgO and CO_2, measured by a new bomb calorimeter method, is $22{\cdot}6 \pm 0{\cdot}5$ kg.-cal. per mol. The following are the most reliable vals. for heat of formation in the reaction $MO + CO_2 \rightarrow MCO_3$ at 20° (M = metal): Cu 7—10 (malachite 13·8, azurite 20·9); Mg 23; Ca (calcite) 42·5 (aragonite only slightly higher); Sr 55 (uncertain); Ba 61; Zn 16·9; Cd 19 (uncertain); Pb 18·9; Mn 15 (to be checked); Fe 16 (to be checked); Co 17—20; Ni ~10. J. L. E.

Correlating gas solubilities and partial pressure data. D. F. Othmer and R. E. White (*Ind. Eng. Chem.*, 1942, **34**, 952—959).—For a gas dissolved in a liquid $\log p = (Q/L)\log P + C$, where p is the partial pressure of the gas, P the v.p. of the solvent, Q the differential heat of dissolution of 1 mol. of gas in its saturated solution, L the latent heat of vaporisation of the solvent, and C a const. Logarithmic plots of this equation for solutions of gases in H_2O and org. solvents are reproduced. Straight lines indicate constancy of Q/L and absence of chemical change, whereas abrupt changes of slope indicate a chemical change. Heats of dissolution can be calc. from the slopes of the lines. C. R. H.

Phase equilibria in hydrocarbon systems. Joule–Thomson coefficients in the methane–propane system. R. A. Budenholzer, D. F. Botkin, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1942, **34**, 878—882).—Joule–Thomson coeffs. of three CH_4–C_3H_8 mixtures have been determined at 70—310° F. and pressures >1500 lb. per sq. in. By combining the results with heat capacity data for the components at infinite vol., the isothermal enthalpy–pressure coeffs. and the partial enthalpies of the conponents have been derived. J. W. S.

System nitric acid–sulphuric acid–water. Enthalpy–temperature nomograph. J. L. McCurdy and C. McKinley (*Ind. Eng. Chem.*, 1942, **34**, 1002—1004).—Two nomographs, one for calculating enthalpy change with temp. for the system and the other showing the relative enthalpy of the system referred to each pure component at 0°, are reproduced. C. R. H.

Disperse structure of solid systems and its thermodynamic basis. VII. D. Balarev (*Kolloid-Z.*, 1942, **99**, 73—77).—Additional evidence in support of the author's theory is presented. C. R. H.

VII.—ELECTROCHEMISTRY.

Physico-chemical properties of rare metals. III. Electric conductivity of the systems $ZrCl_4$–NaCl and $NbCl_5$–NaCl. N. A. Belozerski and B. A. Freidlina (*J. Appl. Chem. Russ.*, 1941, **14**, 466—468).—The conductivity of NaCl at 800—850° is reduced by $ZrCl_4$ (up to 32 mol.-%) and by $NbCl_5$ (up to 22 mol.-%) more than is the mol. fraction or the vol.-% of NaCl; this shows that $ZrCl_4$ and $NbCl_5$ form with NaCl poorly conducting complexes. J. J. B.

Conductances of alkyl sulphates and sulphosuccinates.—See A., 1942, I, 362.

Dicyanotriazole. I. Conductivity of dilute aqueous solutions of dicyanotriazole at 25°. E. G. Taylor (*Canad. J. Res.*, 1942, **20, B**, 161—167).—Measurements of Λ for dil. aq. dicyanotriazole show that its dissociation const. at 25° is $3{\cdot}378 \times 10^{-2}$; Λ_0 is 384·9. A. Li.

Metal–solution contact difference of potential through thin metal films. G. Destriau and (Miss) P. Legendre (*Compt. rend.*, 1942, **214**, 65—67).—For a cell M'|solution of salt of M|M, in which M is electrolytically deposited on M', the polarisation e.m.f. as a function of thickness ϵ of deposited M is investigated. Data and curves are given for cells in which M = Zn, Cu, and M' = Pb, Ag, Au. As the concn. increases, ϵ tends to decrease in the case of Zn and to increase in the case of Cu. N. M. B.

Attempt to correlate the constitution of glass with the potential at glass–electrolyte interfaces. R. C. Ray, P. B. Ganguly, and B. P. Sarkar (*J. Indian Chem. Soc.*, 1942, **19**, 61—66).—The e.m.f. of cells of the type calomel|powdered glass, aq. K_2SiO_3|Ca, Hg has been measured, the results indicating that powdered glass behaves as a sparingly sol. salt. Some evidence is obtained for the existence in glass of the complex silicate, $6SiO_2,CaO,Na_2O$. D. F. R.

Potentiometric study of the oxidation of phenylhydrazine by cupric ions, including the titration of Fehling's solution with phenylhydrazine. H. T. S. Britton and E. M. Clissold (*J.C.S.*, 1942, 528—531).—Fehling's solution (I) can be titrated with $NHPh{\cdot}NH_2$,HCl (II) at $93° \pm 1°$ in an atm. of N_2 by means of the cell bright Pt (2 electrodes)| 100 c.c. of (I) + x c.c. of (II)|saturated KCl|N-KCl|N-KCl + Hg_2Cl_2,|Hg. Oxidation takes place according to two concurrent reactions, viz., (II) + $2CuO \rightarrow C_6H_6 + N_2 + H_2O + Cu_2O$ and (II) + $4CuO \rightarrow PhOH + N_2 + H_2O + 2Cu_2O$, the rates of the two reactions being affected by the concns. of the reactants. The effect of buffers has also been investigated. C. R. H.

VIII.—REACTIONS.

Velocity coefficient of chemical reactions. J. Rodriguez Velasco (*Anal. Fis. Quim.*, 1941, **37**, 487—489).—The observations of González Barredo (A., 1942, I, 332) do not affect the validity of the author's conclusions (A., 1935, 179; 1936, 940; 1937, I, 142). F. R. G.

Influence of a constant error in the calculation of reaction velocities. J. Rodriguez Velasco (*Anal. Fis. Quim.*, 1941, **37**, 263—265).—Systematic errors in the val. of k may be eliminated by determinations made at the val. of t for which the error is a min. F. R. G.

Principles and significance of modern chemical thermodynamics and reaction kinetics. F. Müller (*Angew. Chem.*, 1942, **54**, 334—343).—A review and discussion. A. A. E.

Development of reaction kinetics with special reference to homogeneous gas reactions. H. J. Schumacher (*Angew. Chem.*, 1942, **54**, 329—333).—A review of the work of Bodenstein and others. A. A. E.

Empirical correlation of the activation energies of gaseous unimolecular reactions with vibrational frequencies. P. Fugassi and E. Warrick (*J. Physical Chem.*, 1942, **46**, 630—639).—The empirical equation $E_{act.} = 2{\cdot}8581\bar{\nu}\,[35{\cdot}5 - 900{\cdot}45\bar{\nu}/D_e]$, where $E_{act.}$ = activation energy, $\bar{\nu}$ = frequency in wave nos., and D_e = heat of dissociation in g.-cal., is proposed. The equation has been applied to existing data for numerous reactions. C. R. H.

Isentropic changes of state in dissociating gases and the sound dispersion method of investigating very rapid homogeneous gas reactions. G. Damköhler (*Z. Elektrochem.*, 1942, **48**, 62—82, 116—131).—Mathematical. C. R. H.

Mathematical explanation of the time equation for calculation of velocity of oxidation of nitric oxide to nitrogen peroxide.—See B., 1942, I, 416.

Chemical kinetics and equilibria. D. Porret (*Helv. Chim. Acta*, 1942, **25**, 472—473).—The examples quoted by Baur (A., 1942, I, 331) do not throw doubt on the fundamental principles of the classical theory of chemical equilibria, as he suggests. J. W. S.

Kinetics of pyrogallolcarboxylic acid. E. Baur and P. Giger (*Helv. Chim. Acta*, 1942, **25**, 527—528).—A reply to Porret (cf. preceding abstract). C. R. H.

Limits of inflammability and ignition temperature of ethyl mercaptan in air. G. W. Jones, R. E. Kennedy, and W. E. Miller (*U.S. Bur. Mines*, 1942, *Rept. Invest.* 3648, 6 pp.).—At room temp. and pressure mixtures containing 2·8—18·2% of EtSH in dry air are inflammable. EtSH ignites at 299° in air and at 261° in O_2. J. W. S.

Mechanism of the thermal reaction between hydrogen and oxygen. G. von Elbe and B. Lewis (*J. Chem. Physics*, 1942, **10**, 366—393).—Explosion limits and reaction rates of H_2 and O_2 have been measured in spherical quartz and Pyrex vessels of different diameter, clean and coated with various substances, at different temp., pressures, ratio of reactants, and with admixture of inert gases. The surface chain-breaking efficiency (ε) is related to λ/d (mean free path ÷ diameter of vessel). For B_2O_3-coated surfaces $\varepsilon \ll \lambda/d$, for KCl, $BaCl_2$, $K_2B_2O_4$, $K_2B_4O_7$, and Na_2WO_4 $\varepsilon \gg \lambda/d$ between the second and third explosion limits, but for $K_2B_4O_7$ $\varepsilon \simeq \lambda/d$ for small reaction rates. The chain-breaking mechanism on different surfaces is discussed. Vals of activation energies and rate coeffs. are given. W. R. A.

Hydrolysis of acid chlorides. II. Thionyl and sulphuryl chlorides. J. Rodriguez Velasco and J. R. Borbolla. **III. Benzoyl, *o*-toluoyl and phenyl-acetyl chlorides.** J. Rodriguez Velasco and A. Ollero. **IV. Acetyl, propionyl and butyryl chlorides.** J. Rodriguez Velasco and A. Ollero. **V. Carbonyl chloride and sulphur dichloride.** J. Rodriguez Velasco (*Anal. Fis. Quím.*, 1941, **37**, 232—237, 238—245, 246—253, 254—262).—II. The velocities of hydrolysis of $SOCl_2$ and SO_2Cl_2 in PhMe at 25° are $17{\cdot}25 \times 10^{-3}$ and $39{\cdot}67 \times 10^{-4}$, respectively. They are inversely $\propto$ the square roots of the second dissociation consts. of H_2SO_3 and H_2SO_4.

III. The velocities of hydrolysis in C_6H_6 at 25° of BzCl, o-$C_6H_4Me{\cdot}COCl$, and $CH_2Ph{\cdot}COCl$ are 0·00023, 0·00130, and 0·00080, respectively. They are not inversely $\propto$ the square roots of the dissociation consts. of the corresponding acids.

IV. The velocities of hydrolysis in PhMe of AcCl, EtCOCl, and Pr^aCOCl are 0·0978, 0·0409, and 0·0208 at 25° and 0·1836, 0·0748, and 0·0372 at 45°. These vals. and those for $CH_2Ph{\cdot}COCl$ and o-$C_6H_4Me{\cdot}COCl$ can be expressed as $\log(k_2/k_1) = 0{\cdot}30(n_2 - n_1)$, where n is the no. of C atoms. There is no great variation in the energies of activation of AcCl, EtCOCl, and Pr^aCOCl whilst their hydrolysis is not catalysed by H^+.

V. The velocities of hydrolysis of $COCl_2$ and SCl_2 in PhMe are 0·0130 and 0·0203 at 25°, 0·0286 and 0·0606 at 45°. Energies of activation are recorded. F. R. G.

Variation of the velocity of decomposition of the hypochlorous ion as a function of concentration of the chloride ion. J. M. González Barredo (*Anal. Fis. Quím.*, 1941, **37**, 220—226).—The velocity $\propto [Cl']$ and $[OCl']^2$. F. R. G.

Autoxidation reactions in olefinic and polyolefinic substances.—See A., 1942, II, 341.

Hydrolysis of propionitrile in concentrated hydrochloric acid solutions. B. S. Babinovitch, C. A. Winkler, and A. R. P. Stewart (*Canad. J. Res.*, 1942, **20, B**, 121—132).—For [HCl] <4N. the rate of hydrolysis of EtCN is measured by rate of NH_3 production. For concns. 5—10N, where there is an induction period which is especially prominent at 6·5—8·5N., the rate of hydrolysis is measured by rate of formation of NH_3 + $EtCO{\cdot}NH_2$. At lower [HCl] the rate of amide formation (k_1) is $\ll$ rate of acid formation (k_2), but with increase in [HCl] k_1 increases rapidly whereas k_2, after increasing to a max. in 3N-HCl, decreases. In 1N- and 10N-HCl $k_2/k_1 = 2000$ and 0·025 respectively. The change of k_1 with [HCl] is partly accounted for by a decrease of 6·7 kg.-cal. in the activation energy over this range. C. R. H.

Hydrolysis of propionitrile in concentrated solutions of mineral acids. J. D. McLean, B. S. Rabinovitch, and C. A. Winkler (*Canad. J. Res.*, 1942, **20, B**, 168—173).—The vals. of k_1 and k_2 for the unimol. reactions $EtCN \rightarrow (k_1)$ amide $\rightarrow (k_2)$ acid in different concns. of HBr, HNO_3, and H_2SO_4 have been determined. For acid concns. <4N., $k_1 \ll k_2$. At higher concns., k_1 and k_2 are of the same order, but above 20N., $k_1 \gg k_2$. The observed activation energy decreases with increasing acid concn. A. LI.

Decomposition of benzoyl peroxide in benzene. J. H. McClure, R. E. Robertson, and A. C. Cuthbertson (*Canad. J. Res.*, 1942, **20, B**, 103—113).—The decomp. of Bz_2O_2 in C_6H_6 has been studied at 66—78° by determination of the CO_2 formed, Bz_2O_2 present, and BzOH produced. It is inferred that the initial slow process involves the formation of two OBz radicals, but the fact that the total CO_2 evolved in the reaction varies with temp. indicates that the mechanism involves two parallel fast reactions, evolving one and two mols. of CO_2, respectively, per mol. of Bz_2O_2 decomposed. The latter reaction predominates at higher temp. If H atoms are formed in the decomp., there is no appreciable union of these to form H_2 mols. The reaction is of first order and the energy of activation is ~31,000 g.-cal. per g.-mol. J. W. S.

Affinity. J. Rodriguez Velasco (*Anal. Fis. Quím.*, 1941, **37**, 557—570).—Reaction velocities of AcCl, $CH_2Cl{\cdot}COCl$, $SOCl_2$, SO_2Cl_2, AcBr, and $CH_2Br{\cdot}COBr$ in PhMe at 25° and 35° are in agreement with Dimroth's theory of the relation between reaction velocity and chemical affinity. F. R. G.

Hydrolysis of thiolactones and lactonisation of mercapto-acids.—See A., 1942, II, 347.

Ether-like compounds. XXVI. Rate of reaction and intramolecular forces.—See A., 1942, II, 297.

Rate of reaction of oleic acid with oxygen. J. L. Henderson and H. A. Young (*J. Physical Chem.*, 1942, **46**, 670—684).—After a 5-hr. induction period the absorption of O_2 by oleic acid at 80° is expressible by $-dO_2/dt = k_1 + k_2[\text{oleic acid}]_{initial} \times [O_2]^{0{\cdot}5}$ where, since peroxide formation occurs, $[\text{oleic acid}]_{initial}$ can be replaced by [peroxide]. Double bond destruction is involved in the peroxide formation. C. R. H.

Degradation of long chain-form molecules. I. Sakurada and S. Okamura (*Z. physikal. Chem.*, 1940, **A, 187**, 289—296).—On the basis of Kuhn's statistical treatment (A., 1930, 1025) an equation relating the mol wt. of the degradation product, as determined viscosimetrically by Staudinger's method, with the no. of linkages broken in the original long-chain mol. has been derived. The equation is in accord with observation for the hydrolytic degradation of cellulose in 7·7—10·75M-H_2SO_4. J. W. S.

Systematics of mixed polymerisates. E. Jenckel (*Z. physikal. Chem.*, 1941, **A, 190**, 24—42).—The types of product resulting, and the effects of fractionation on them, when a mixture of two polymerisable substances is subjected to polymerisation are considered theoretically, and a no. of special cases, depending on the relative rates of the various reactions of chain-growth, are distinguished. Approximations to some of these have been realised experimentally. F. J. G.

Periodic dissolution of lead amalgams. F. Halla and E. Neusser (*Naturwiss.*, 1942, **30**, 198—199).—Pb amalgams dissolve in HNO_3 intermittently, the periods of dissolution and rest varying with the temp. and concn. of the acid. For a 3·5% Pb amalgam in 9·1M-HNO_3 at 21° the period is 40 sec. and in 11M-acid 2—8 sec. For a 0·1% Pb amalgam in 3M-HNO_3 the period is reduced to ½ of its original val. by a rise in temp. from 31° to 41°; the gas evolved contains NO_2 8, O_2 2, NO 69, and undetermined gas 21 vol.-%. Prolonged action of the acid results in the formation of a yellow powder, mostly $HgNO_2$, free from Pb. HNO_2, KCN, and $NaAsO_2$ are active catalysts and $CO(NH_2)_2$, urethane, CH_2O, and KI are inhibitors of the reaction. No pulsations occur with $HClO_4$. A. R. P.

Chemical kinetics and chemical catalysis. A. Skrabal (*Angew. Chem.*, 1942, **54**, 343—346).—A lecture. A. A. E.

Active nitrogen. III. Experiments to show that traces of oxygen or other impurity affect primarily the walls of the vessel, and not the phenomena in the gas space. IV. Ionisation associated with active nitrogen. (Lord) Rayleigh (*Proc. Roy. Soc.*, 1942, **A, 180**, 123—139, 140—150; cf. A., 1941, I, 429).—III. The effect of minute gaseous impurities in promoting the formation of active N is studied. The effect of O_2 is to modify the glass wall of the reaction vessel in such a way as to favour the accumulation of active N. The restoration of the afterglow by the addition of a tributary stream of O_2 was observed in an electrodeless discharge at low pressure. The phenomena are complicated and not susceptible to simple explanation. The effect of various treatments of the glass vessel was also studied; heating in vac. or N_2 destroys the glow, whilst heating in O_2 at 1 mm. pressure restores the glow. These effects are not easily explained by the formation and removal of gas layers. The behaviour of the gas away from the surface of the vessel was investigated and it was found that the addition of a trace of O_2 has no effect in promoting the active N phenomena.

IV. The ionisation which is associated with the afterglow in

active N is not a photo-electric effect produced by light of $\lambda > 1580$ A., nor is it increased by allowing the surface temp. of the Au test cathode to rise to red heat. The material of the cathode has but little effect except in the case of Cu, which, when clean, gives an effect several times larger than after it is dulled by use. There may be some surface emission of electrons which is usually $\ll$ the vol. ionisation in the gas. The ratio of the no. of light quanta emitted to the no. of ion pairs generated per c.c. of gas diminishes from about 10 to 1 as the glow decays. The introduction of inert N_2 increases both the emission of photons and the ionisation.

G. D. P.

Effect of inhibitors on the rate of oxidation of copper by oxygen in phosphoric acid solutions. R. W. Lawrence and J. H. Walton (*J. Physical Chem.*, 1942, **46**, 609—616).—The rate of corrosion of Cu powder in $2N\text{-}H_3PO_4$ $\propto [O_2]$ and $[Cu^{\cdot\cdot}]$. Corrosion is inhibited by amines as a result of adsorption of amine cations on the cathodic areas of Cu, the order of effectiveness being $NR_3 > NHR_2 > NH_2R$. In the case of NH_2R increase in size of R increases inhibitory action.

C. R. H.

Hydration of unsaturated compounds. VIII. Rate of hydration of ββ′-dimethylacrylic acid; rates of dehydration and decarboxylation of β-hydroxy*iso*valeric acid. D. Pressman and H. J. Lucas (*J. Amer. Chem. Soc.*, 1940, **62**, 2069—2080; cf. A., 1939, I, 570).—Kinetic data are given for the acid-catalysed hydration of ββ′-dimethylacrylic acid (**I**) to β-hydroxy*iso*valeric acid (**II**) (prep. of *Ag* salt described) and the reverse dehydration process at 82·45° (hydration only), 99·85°, and 111·85°, in aq. $HClO_4$ and $NaClO_4$ at different $[H^{\cdot}]$ and ionic strengths (I). Interference by the simultaneous decarboxylation of (**II**) to $Bu^{\gamma}OH$, studied under similar conditions, renders necessary a new mathematical treatment of reactions of the type $A \rightleftharpoons B \rightarrow C$ in which the k vals. are comparable. All the reactions cited are first-order with respect to $[H^{\cdot}]$ and the org. acid concn.; the k vals. increase rapidly with I, and slowly as $Na^{\cdot}$ replaces $H^{\cdot}$ at const. I. The uncatalysed decarboxylation of (**II**) in H_2O and aq. $NaClO_4$ (99·85° and 111·85°) is also first-order with respect to [(**II**)], and involves non-ionised acid mols.; k is $<$ in the catalysed reaction, and increases moderately with I. The rate of decarboxylation of (**I**) is negligible. The heat of activation of the hydration of (**I**) is independent of I and $[H^{\cdot}]$; $\Delta H = -8{\cdot}1$ kg.-cal. [corr. val. for crotonic acid (*loc. cit.*), $-5{\cdot}4$ kg.-cal.].

A. J. E. W.

Mechanism of the catalytic reduction of carbonyl compounds.—See A., 1942, II, 348.

Thermal fission of *p*-cymene.—See A., 1942, II, 304.

Influence of catalysts on oxidation of turpentine.—See B., 1942, II, 380.

Copper–nickel catalyst for hydrogenation of oils.—See B., 1942, II, 377.

Valency states of metals of group VI*a* attainable in a pure state in aqueous solution. W. D. Treadwell and R. Nieriker (*Helv. Chim. Acta*, 1941, **24**, 1067—1079).—An electrolytic reduction vessel which permits quant. reduction of dil. solutions without concn. change is described. With this apparatus in presence of H_2SO_4, $K_2Cr_2O_7$ is reduced to $CrSO_4$ and UO_2SO_4 to $U_2(SO_4)_3$, whilst in the presence of H_3PO_4, W^{VI} and U^{VI} are reduced to W^{IV} and U^{IV}. Reduction of Cr^{VI} to Cr^{II} is incomplete in H_3PO_4, but evidence is obtained of the reduction of Mo^{VI} to Mo^{II}. In a Cd reducer H_2WO_4 in dil. H_3PO_4 is reduced quantitatively to the light-sensitive deep blue W^{V} phosphate. Electrometric titration curves of the reduced solutions with $KMnO_4$ are given. A method for titrating H_2WO_4 with $V_3(PO_4)_2$ is described.

J. W. S.

Chemical action of electric discharges. XXIII. Partition of electrical energy used in production of ozone and oxidation of nitrogen in oxygen–nitrogen mixtures submitted to the action of the discharge. XXIV. Formation of nitrogen oxides by action of the discharge on commercial oxygen. E. Briner and G. Papazian (*Helv. Chim. Acta*, 1941, **24**, 844—851, 919—921; cf. A., 1940, I, 226).—XXIII. The distribution of energy between formation of NO and of O_3 in an a.c. arc in N_2–O_2 mixtures has been studied. In all cases the energy consumed on O_3 formation largely predominates. The NO yield is little affected by changes in pressure or the rate of gas flow, but is reduced by ~50% by cooling the discharge zone to $-75°$. The effect of mixture composition (N_2 2—98%) is examined; the highest NO yields are obtained with 90—95% of N_2.

XXIV. The quantity of N oxides ($1{\cdot}4 \times 10^{-4}$ vol.-% of NO under conditions favourable to NO formation) produced during ozonisation of commercial O_2 (containing 2·2% of N_2) in an a.c. arc is insufficient to render the O_3 unsuitable for use, *e.g.*, for medical purposes. If necessary the N oxides can be removed by keeping the gas over H_2O.

A. J. E. W.

Chemical action of electric discharges. XXV. Production of hydrogen cyanide and ammonia by means of the high-frequency arc operating in gas from the distillation of wood. XXVI. Production of acetylene by means of the high-frequency arc operating in gas from the distillation of wood. E. Briner, J. G. de Werra, and J. P. Jacob (*Helv. Chim. Acta*, 1941, **24**, 1006—1010, 1010—1013).—XXV. At pressures <45 mm. and using an arc of frequency 10^7 cycles per sec. the gas obtained by distillation of wood, mixed with excess of N_2, yields both HCN and NH_3. The optimum energy yields were HCN 25 g. and NH_3 2 g. per kw.-hr.

XXVI. At <45 mm. pressure the high-frequency arc gives a yield of >100 g. of C_2H_2 per kw.-hr. when operating in wood-gas alone, but only ~55 g. per kw.-hr. in the presence of excess of N_2 when greater yields of HCN and NH_3 are obtained. These conditions, however, permit the utilisation of both the H_2 and CH_4 in the gas.

J. W. S.

Mechanism of processes initiated by excited atoms. I. Quenching of excited sodium. II. Photosensitisation by excited mercury and cadmium. K. J. Laidler (*J. Chem. Physics*, 1942, **10**, 34—42, 43—50).—I. Potential energy surfaces relevant to a no. of simple processes involving excited ^2P Na have been constructed and the mechanism of the reactions is discussed in terms of these and of the theory of abs. reaction rates. Quenching by atoms is normally very inefficient and addition of atoms in a quencher stabilises a quenched complex, usually polar, which finally decomposes to give the deactivated atom and a vibrationally excited product. Quenching by H and other atoms, H_2, halogen mols., and hydrocarbons is of a physical nature. Saturated hydrocarbons appear to quench like H_2 but unsaturated hydrocarbons quench by interaction between Na atoms and the unsaturated group.

II. An extension to excited Hg and Cd in their triplet and singlet states. With H_2 quenching of a physical nature is prohibited for the triplet atoms by the need for conserving spin angular momentum and dissociation must occur with initial formation of the metal hydrides. These are formed also with $^3P_0$ Hg and with $^3P_0$ and $^3P_1$ Cd but with $^3P_1$ Hg and the singlet excited atoms the hydride dissociates into the metal and a H atom immediately. Quenching to the metastable state is usually inefficient. The atoms react with saturated hydrocarbons by splitting off H, but unsaturated hydrocarbons usually interact with initial formation of excited mols. which, when activated by singlet atoms, have vibrational energy only but when activated by triplet atoms are excited to triplet electronic states. The subsequent reactions of the excited olefines are discussed.

W. R. A.

Effect of gradual light absorption in photographic exposure. L. Silberstein (*J. Opt. Soc. Amer.*, 1942, **32**, 326—331).—The author's theoretical treatment (cf. *e.g.*, A., 1940, I, 79), for the one- or two-quantum hypothesis, is generalised to cover any elementary exposure law.

L. J. J.

Temperature and interrupted photographic exposure. J. M. Blair (*J. Opt. Soc. Amer.*, 1942, **32**, 332—333).—A second exposure of an exposed Azo 0 emulsion after a rest period causes an initial decrease in developable density for high, but not for low, densities. The effect extends to lower densities with increasing temp. up to 80°.

L. J. J.

Desensitisation of silver bromide. V. Girtanner (*Helv. Chim. Acta*, 1941, **24**, 725—746).—The theory of desensitising action is reviewed. 27 org. and inorg. compounds have been tested for such action with a liquid AgBr emulsion; positive effects are given by phenosafranine, pinakryptol-yellow, $HgCl_2$, and KBr. The effect of concn. on desensitisation has been studied with 15 org. desensitisers in dried AgBr emulsions. The results confirm Baur's theory of photolysis and desensitisation. A colorimetric method for determination of Ag produced photolytically in liquid AgBr emulsions is described.

A. J. E. W.

Desensitisation and anticatalysis. E. Baur (*Helv. Chim. Acta*, 1941, **24**, 747—753).—A review and discussion, illustrated by tables comparing numerous known reactions, of the mechanism of desensitisation and its relation to anticatalysis.

A. J. E. W.

Photosensitive complexes in the photolysis of uranyl oxalate and their dissociation constants. L. J. Heidt (*J. Physical Chem.*, 1942, **46**, 624—630).—New data confirm the conclusion that in UO_2SO_4–$H_2C_2O_4$ solutions there exist three photosensitive clusters, viz., $UO_2H_2C_2O_4^{\cdot\cdot}$, $UO_2C_2O_4$, and $UO_2(C_2O_4)_2''$. The data are discussed with reference to gross and net quantum yields, as is also the observation that H_2SO_4 lowers the gross quantum yield $>$ is expected.

C. R. H.

Polymerisation of ethylene photosensitised by 5^1P_1 cadmium atoms. E. W. R. Steacie and D. J. LeRoy (*J. Chem. Physics*, 1942, **10**, 22—34).—Unlike 5^3P_1 Cd atoms, 5^1P_1 atoms photosensitise reactions of C_2H_4 readily and the chief products are olefines (C_3H_6, C_4H_8, C_6H_{12}, and higher members) with smaller amounts of C_2H_2 and H_2. C_2H_2 is a much less important product than when Hg photosensitisation is employed. No rise in pressure is detectable in the early stages of the reaction. Alternative primary steps are Cd $(^1P_1) + C_2H_4 =$ Cd $(^1S_0) + C_2H_3 + H$ and $=$ Cd $(^1S_0) + C_2H_4{}^*$. Subsequent polymerisation takes place probably by a free radical mechanism.

W. R. A.

Photolysis of dimethylhydrazine. W. L. Kay and H. A. Taylor (*J. Chem. Physics*, 1942, **10**, 497—504).—$(NHMe)_2$ shows continuous absorption from 2800 A. to <2000 A. Photolysis, initiated by

scission of a H atom, yields H_2, N_2, CH_4, NH_3, NH_2Me, and $(NMe{:}CH_3)_2$ from $3(NHMe)_2$, with overall quantum yield 0·3. L. J. J.

Experiments on chlorophyll and photosynthesis using radioactive tracers.—See A., 1942, III, 861.

Sulphochlorination and chlorination of gaseous hydrocarbons.—See A., 1942, II, 296.

Mechanism of the action of ionising rays on water. R. Latarjet (*Compt. rend.*, 1942, **214**, 73—75).—The formation of H_2O_2 by direct decomp. of H_2O and by a secondary process originating in the liberated O_2 is examined. N. M. B.

Electronic exchanges in water under the action of *X*-rays. J. Loiseleur (*Compt. rend.*, 1942, **214**, 76—78; cf. preceding abstract). —Theoretical. Evidence indicates that the ionisation of O_2 is due to direct transfer, under the action of *X*-rays, of electrons from two OH ions to the O_2 mol., *i.e.*, $2OH^- + O_2 \rightarrow H_2O_2 + \text{-O-O-}$. N. M. B.

Photographic action of electrons in the range between 40 and 212 kv. R. F. Baker, E. G. Ramberg, and J. Hillier (*J. Appl. Physics*, 1942, **13**, 450—456).—The intensity–log exposure curves of photographic plates are similar for electrons from 40 to 212 kv. The abs. sensitivity of the plate increases with voltage up to ~100 v., after which it decreases sharply. The sensitivity at high voltages may be increased by a thin high-density screen, of Ag or Cellophane, on the surface of the plate. O. D. S.

IX.—METHODS OF PREPARATION.

Transmutation of the elements. O. Hahn (*Naturwiss.*, 1942, **30**, 245—250).—A review. A. J. M.

Exchange of radioactive silver with silver chloride suspensions. A. Langer (*J. Chem. Physics*, 1942, **10**, 321—327).—Ag^* ions in solution exchange constantly with Ag^* ions of a AgCl suspension not only on the surface but, probably by self-diffusion, throughout the particles until a steady radioactive state of homogeneous distribution of Ag^* throughout the system is obtained. The area of the crystal surface is the determining factor on the time necessary to obtain a given fraction of complete exchange for a given amount of ppt. W. R. A.

Gallium. IV. Gallium hydroxylammonium alum and double sulphates of gallium and primary, secondary, and tertiary aliphatic amines. P. Neogi and K. L. Mondal (*J. Indian Chem. Soc.*, 1942, **19**, 67—68).—The following *compounds* have been prepared
$(NH_2OH)_2,H_2SO_4,Ga_2(SO_4)_3,24H_2O$,
$(C_5H_{11}{\cdot}NH_2)_3,H_2SO_4,Ga_2(SO_4)_3,16H_2O$,
$(NH_2Bu)_3,H_2SO_4,Ga_2(SO_4)_3,16H_2O$,
$(NHEt_2)_2,H_2SO_4,Ga_2(SO_4)_3,18H_2O$,
$[N(C_5H_{11})_3]_2,H_2SO_4,Ga_2(SO_4)_3,16H_2O$, and
$(NMe_3)_2,H_2SO_4,Ga_2(SO_4)_3,18H_2O$. D. F. R.

Rare-earth metal amalgams. II. Separation of neodymium, samarium, and gadolinium. J. K. Marsh (*J.C.S.*, 1942, 523—526). —Sm can be separated from Sm–Nd and Sm–Gd mixtures by treating a solution of the acetates with Na amalgam at p_H 8—9. Where Sm is present in small amount, p_H 4—5 is more suitable, max. production of the amalgam with Nd or Gd being formed instead of the amalgam with Sm. C. R. H.

Chemistry of metal carbonyls. W. Hieber (*Angew. Chem.*, 1942, **55**, 7—11, 24—28).—A lecture.

Alkaline earth arsenates. System As_2O_5–CaO–H_2O. H. Guérin (*Ann. Chim.*, 1941, [xi], **16**, 101—153; cf. A., 1938, I, 359; 1939, I, 27).—The following salts were prepared and characterised at the temp. stated: at 17° $CaH_4(AsO_4)_2$ (I), $Ca_2H_2(AsO_4)_2,6$ (II), 4 (III), and 2 (IV) H_2O, $5CaO,2As_2O_5,10H_2O$ (V), $Ca_3(AsO_4)_2,10H_2O$ (VI), $4CaO,As_2O_5,5H_2O$; at 40° (I), (II), (III), (IV), (V), $5CaO,2As_2O_5,5H_2O$ (VII), $4CaO,As_2O_5,H_2O$ (VIII); at 60° (I), (II), (III), (IV), (VII), $Ca_3(AsO_4)_2,2H_2O$ (IX), (VIII); at 90° CaO,As_2O_5, (I), (IV), $Ca_2H_2(AsO_4)_2$, (VII), (IX), (VIII). Of these (III) is unstable at 60°, and (V) and (VI) at 40°; (VII) is metastable at 90°. The unstable hydrate (II) is formed by the action of As_2O_5 on $Ca(OH)_2$ or $CaCO_3$ in aq. suspension, but not by double decomp. between $CaCl_2$ and Na_2HAsO_4. It is transformed into pharmacolite (III) or haidingerite (IV) according to whether the p_H of the liquid is > or <6. Hydrolysis is generally marked at the higher temp. and is shown by the displacement of the fields of stability of the various salts towards more acid solutions. $Ca_3(AsO_4)_2$ is not hydrolysed, even at 90°. Cryst. and other properties are described. F. L. U.

Chemistry of sulphur trioxide. P. Baumgarten (*Angew. Chem.*, 1942, **55**, 115—118).—A lecture.

Reaction of sulphur dioxide with sodium thiosulphate. C. Chorower (*Anal. Fis. Quim.*, 1941, **37**, 571—593).—In the reaction between SO_2 and $Na_2S_2O_3$ the absorption of $SO_2 \propto [Na_2S_2O_3]$; the formation of Na_2SO_4 is insignificant until the solution is exposed to the air during evaporation. This results in the decomp. of the polythionates which, on complete evaporation, form Na_2SO_4 and S. The completed reaction is $2Na_2S_2O_3 + SO_2 = 2Na_2SO_4 + 3S$. F. R. G.

Calcium sulphate as a source of sulphur chlorides. I. Chlorination of calcium sulphate in presence of reducing agents. II. Optimum conditions for the chlorination process. P. P. Budnikov and E. I. Kretsch (*J. Appl. Chem. Russ.*, 1941, **14**, 747—754, 755—765; cf. A., 1936, 1211).—I. When the mixture $CaSO_4$ (gypsum) + 4C (lignin C) was chlorinated over the range 225—850°, the $CaSO_4$ began to decompose at 345° to give S chlorides (I), the yield of S as SO_3 rising rapidly as the temp. increased to 725° (96% yield). The max. yield of S at 740—750° was obtained with the mixture $CaSO_4$ + 3C. Under these conditions, max. yields were obtained using soot or lignin C or sugar C (98·5—98·7%), and the lowest yield with coke (87·4%); anthracite, bone C, or electrode C gave intermediate yields. At the optimum conditions [740—750°, $CaSO_4$ + 3C (lignin)], the reaction was very rapid, a 96% yield being obtained in 15 min. The addition of NaCl or Na_2SO_4 (0·1 g.-mol. per g.-mol. $CaSO_4$) increased the speed of the reaction at 630—640°; addition of Fe_2O_3 or of SiO_2 decreased the yield of S. All experiments were carried out with small samples.

II. Repetition confirmed the above results for larger quantities of the reactants. The optimum temp. for the prep. of (I) by chlorinating the stoicheiometric mixture $CaSO_4$ + 3C (anthracite) + 0·1M-Na_2SO_4 (all previously baked together at 600—800°) was 700—750°. Chlorination of the stoicheiometric mixture $CaSO_4$ + 4C + 0·1M-Na_2SO_4 produced both CS_2 and (I). The heat produced during these reactions is calc. N. G.

Statistics in sulphide and phosphide chemistry. W. Biltz (*Angew. Chem.*, 1942, **54**, 320—321).—A lecture. A. A. E.

Isolation and some properties of element 93. F. Strassmann and O. Hahn (*Naturwiss.*, 1942, **30**, 256—260).—A method of separating element 93 (I) from U, U-*X*, etc. is described. The separation of U as Na uranyl acetate is discussed. (I) is not pptd. by oxine, and a method of separation is based on this fact. Some analytical reactions of (I) are described. It is not pptd. by H_2S, but is completely pptd. by aq. NH_3 when it is in either the oxidised or the reduced state. It is only partly pptd. from dil. HCl solution by $H_2C_2O_4$ or $(NH_4)_2C_2O_4$, or by tartaric acid and aq. NH_3. Boiling with NaOAc and H_2O_2 ppts. (I) in the presence of La and Ce. It is also pptd. from a conc. HNO_3 solution containing bromate and U by the addition of NaOAc. $(NH_4)_2S$ ppts. (I). A. J. M.

X.—ANALYSIS.

Colour nomenclature in qualitative analysis. I. Inter-Society Colour Council nomenclature. L. P. Biefeld and M. Griffing (*J. Chem. Educ.*, 1942, **19**, 282—286). L. S. T.

Adsorption analysis of gases and vapours. G. Hesse and B. Tschachotin (*Naturwiss.*, 1942, **30**, 387—392).—The method of chromatographic analysis has been extended to substances of low mol. wt. and to gases. The mixture is vaporised, and passed with a carrier gas (corresponding with the solvent) into a heated adsorption tube containing SiO_2 gel. The vapour passing through is condensed and analysed. The method has been applied to the separation of C_6H_6 and *cyclo*hexane (I). The initial and final fractions were optically pure, and it was possible to obtain 52% of the (I) containing <1% of C_6H_6. The separation of a C_6H_6–*cyclo*hexene (II) mixture was difficult, but with a greater quantity of adsorbent 25% of (II) was obtained optically pure. C_6H_6 and CCl_4 were easily separated, but $Pr^{\beta}OH$ and $Bu^{\gamma}OH$ could not be separated. *cis*- and *trans*-$C_2H_4Cl_2$ were partly separated. SiO_2 is a better adsorbent than activated C. H_2, N_2, CO_2, N_2O, and NH_3 were used as carrier gases, and of these H_2 was the best. The optimum flow was 1 l. per hr. The temp. of the adsorbent should be as low as possible. Earlier experiments are reviewed. A. J. M.

Micro-determination of bromide as pentabromorosaniline. W. J. Turner (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 599—600).—Br' is oxidised to Br by means of $K_2S_2O_8$ and conc. H_2SO_4, and substituted in rosaniline. The pentabromorosaniline is extracted by means of $CH_3Ph{\cdot}OH$ from 7N-H_2SO_4, and determined photometrically. The method can be applied to biological fluids without preliminary separation from Cl'. L. S. T.

Micro-test for iodide. D. Hart and R. Meyrowitz (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 606; cf. A., 1941, I, 119).—The catalytic effect of I' on the NO_2'–AsO_3''' oxidation–reduction reaction is utilised for detecting 1 μg. of I' in a concn. of 1 in 5×10^4 in presence of 500 μg. of CNS', Br', or Cl'. 1 drop of M-Na_3AsO_3 and 2 of H_2O are mixed with 1 of test solution. 2 drops of conc. HNO_3, and after 2 min., 3 drops of 0·5M-$AgNO_3$ and 1·5M-Na_2CO_3 are added. A red-brown ppt. of Ag_3AsO_4 shows the presence of I'. L. S. T.

Ozone as an analytical reagent. II. Determination of iodides. H. H. Willard and L. L. Merritt, jun. (*Ind. Eng. Chem.*, [*Anal.*], 1942, **14**, 489—490).—I' and other I compounds are oxidised quantitatively to IO_4' by O_2 in 1—10% NaOH. Br' in concns. >0·6 g., but not Cl', interferes. The IO_4' is allowed to react with

I′ in a neutral or acid solution, and the I liberated titrated with AsO_3''' or $Na_2S_2O_3$. L. S. T.

Determination of dissolved oxygen [in boiler feed water].—See B., 1942, I, 393.

Detection of peroxides with luminol. H. Druckrey and R. Richter (*Naturwiss.*, 1941, **29**, 28—29).—Luminescence is produced when esters are hydrolysed with aq. KOH or when acids are neutralised with alkali in presence of luminol (**I**) at room temp. Dissolution of alkali in aq. (**I**) or heating of aq. alkali containing (**I**), especially in presence of hæmin (**II**), also produce luminescence. In all cases there is no luminescence in absence of atm. O_2. Glucose, lactates, salicylic acid, and glycerol in alkaline solution and in presence of O_2 cause luminescence of (**I**) with or without the presence of (**II**), in accord with the paradox that many reducing agents, but few oxidising agents, give the reaction attributed to H_2O_2. It is suggested that (**I**) acts both as a substratum for dehydrogenation by atm. O_2 and as a chemiluminescent substance through the H_2O_2 formed in this reaction. The rate of dehydrogenation of (**I**) at room temp. is so slow that no visible luminescence appears until higher temp. are reached. The energy liberated by neutralisation, dissolution, sound waves, or by other oxidation processes may accelerate this dehydrogenation and so cause luminescence. J. W. S.

Direct determination of sulphur. G. L. Mack and J. M. Hamilton (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 604—606).—Colloidal Cu_2S formed by the reaction between S in $COMe_2$ with ammoniacal Cu_2SO_4 reagent (prep. from $CuSO_4$, aq. NH_3, and NH_2OH,HCl) is determined turbidimetrically. 1 μg. of S in 10 ml. of solution can be detected. CS_2, inorg. sulphides, and xanthates, but not SO_4'', SO_3'', S_2O_3'', CNS′, org. sulphides, sulphones, mercaptans, and phenols, react with the reagent. CCl_4 produces a red colour. The method has been applied to S in spray residues. L. S. T.

Oxidimetric determination of dithionate. R. Lang and H. Kurtenacker (*Z. anal. Chem.*, 1942, **123**, 81—96).—The use of various oxidising agents in the determination of S_2O_6'' has been investigated. HVO_3 is the most suitable, as it is not decomposed by prolonged boiling in conc. acid, it oxidises S_2O_6'' quantitatively to SO_4'', and the $VO^{\cdot\cdot}$ produced can be titrated with $KMnO_4$. The solution, containing ≯0·24 g. of S_2O_6'', is treated with 0·2N-HVO_3 (20 c.c.) and 10N-H_2SO_4 (30—50 c.c.) and the mixture is diluted to 100 c.c. It is then boiled gently in a flask closed with a funnel for 20 min., the boiling solution then being titrated with 0·1N-$KMnO_4$ until the colour changes from yellow to brownish-violet. Other S compounds which may interfere should be oxidised to SO_4'' by treating with NaOH and $KMnO_4$. After 15—20 min. excess of 2% aq. $MnSO_4$ is added, the solution is diluted to a definite vol., filtered, and an aliquot used for S_2O_6'' determination. H_2O_2 can be used to remove SO_3'' but is unsuitable in the presence of S_2O_3'', S_3O_6'', or S″. The presence of ≯2 g. of Cl′ does not interfere with the S_2O_6'' determination. J. W. S.

Determination of selenium in copper.—See B., 1942, I, 429.

Determination of ortho-, pyro-, meta-, and poly-phosphates in presence of one another. L. T. Jones (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 536—542).—Procedures for determining ortho-, pyro-, hexameta-, trimeta-, and poly-phosphates are described. Hexametaphosphate (**I**) is separated as the Ba salt in acid solution, and P_2O_7'''' is pptd. as $Mn_2P_2O_7$ at p_H 4·1 in presence of $COMe_2$ after removal of (**I**). Polyphosphates are obtained from the difference between total P_2O_5 and the sum of the P_2O_5 vals. of the other phosphates. Data showing the application of the methods to synthetic phosphate and carbonate and silicate mixtures, and commercial phosphates, are given. L. S. T.

Detection of orthophosphates by means of drop reactions. P. W. West and T. Houtman (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 597—599).—Interferences to which the strychnine–molybdate, the NH_4 molybdate (**I**)–$SnCl_2$, and the (**I**)–benzidine (**II**) tests are subject are recorded. A modified strychnine–molybdate test, in which the yellow ppt. formed is reduced by means of (**II**) (blue-green colour), and which is more selective, but still subject to certain interferences, is described. L. S. T.

Fluorescein as an indicator in bromometric titrations. F. L. Hahn (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 571).—In the titration of AsO_3''' in acid solution with BrO_3'–Br′, 1 drop of 0·1% fluorescein per 10 ml. of solution gives a reddish-brown colour at the end-point. Heating to 40—50° accelerates the reaction. L. S. T.

Determination of quartz in finely grained minerals. H. Jung (*Naturwiss.*, 1942, **30**, 266—267).—The mineral is treated with HBF_4 which dissolves felspar, mica, and clays, but does not attack quartz. A. J. M.

Determination of the quartz content of industrial dusts.—See B., 1942, III, 224.

Spectrographic analysis of inclusions [in steel] containing silica and alumina.—See B., 1942, I, 426.

Chromatographic methods in organic chemistry. III. Determination of potassium and sodium ions. H. Erlenmeyer and J. Schmidlin (*Helv. Chim. Acta*, 1941, **24**, 1213—1218).—When passed through a mixture of starch (2 parts) and 5-keto-4-oximino-3-phenyl*iso*oxazoline (**I**) (1 part), KOAc yields a sharp yellow zone not removed by washing, whereas the corresponding red zone with NaOAc is removed by washing. If the mixture containing (**I**) is packed into the upper half of a tube and a mixture of starch (3 parts) with violuric acid (1 part) in the lower half of the tube, the Na when washed down forms a stable red zone. The method can be used for the determination of Na and K in presence of one another, but when these elements are in the same ratio as in body fluids (17·25 : 1) it is necessary to use two tubes, of different diameters, for accurate measurements, as the use of a tube narrow enough to give a reasonably long K zone demands very prolonged washing to obtain the full Na zone. J. W. S.

Gravimetric micro-determination of magnesium. P. F. Holt (*Analyst*, 1942, **67**, 256—257).—The ppt. obtained in the micro-determination of Mg as $NH_4MgPO_4,6H_2O$ (A., 1930, 1544) gives a max. error of 0·8% when the time of pptn. is fixed at 5 hr. and the factor for conversion of wt. of ppt. to wt. of Mg is 0·09703 (substantially < the theoretical). S. B.

Electrolytic determination of zinc in aluminium solutions.—See B., 1942, I, 433.

Volumetric determination of lead. P. C. Banerjee (*J. Indian Chem. Soc.*, 1942, **19**, 87—88).—Pb is pptd. with excess of KIO_3 and titrated back with $Na_2S_2O_3$. D. F. R.

Dye extremely sensitive to copper. F. L. Stearns (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 568—569).—Benzo Fast Yellow 5GL (Colour Index, No. 346) is 40 times as sensitive to $Cu^{\cdot\cdot}$ as $NEt_2{\cdot}CS_2Na$ (**I**) and by its use 10^{-7} g. of $Cu^{\cdot\cdot}$ per l. can be determined with the spectrophotometer. In visual determination the sensitivity of the test equals that of (**I**) since the colour change of yellow to red is not so pronounced as the colour developed by (**I**). J. D. R.

Qualitative reagents for cations. VI. Reagents for gallium cations. P. Wenger and R. Duckert (*Helv. Chim. Acta*, 1942, **25**, 699—704).—The characteristics of various reagents which have been suggested for the detection of Ga''' are tabulated. Details of the sensitivities and specificities of four reagents recommended for use under various conditions are given. J. W. S.

Qualitative reagents for cations. III. Reagents for manganese cations. P. Wenger and R. Duckert [with M. L. Busset] (*Helv. Chim. Acta*, 1941, **24**, 1143—1150).—A no. of reagents which have been suggested for the detection of $Mn^{\cdot\cdot}$ have been tested with regard to sensitivity and specificity. Of these, 9 are recommended for use under various conditions and their characteristics are tabulated. The sensitivities of $NHPh_2$ in conc. H_2SO_4 and of benzidine in HCl for the detection of MnO_4' are also recorded. J. W. S.

Reaction between hydrogen peroxide and potassium permanganate. A. Rius and J. M. Gomeza (*Anal. Fis. Quim.*, 1941, **37**, 442—458).—The difference observed by Foz (*ibid.*, 1940, **36**, 300) between the factor of normality when H_2O_2 or $KMnO_4$ is in excess in the determination of H_2O_2 is attributed to a side-reaction $4KMnO_4 + 5H_2O_2 + 6H_2SO_4 = 4MnSO_4 + 2K_2SO_4 + 11H_2O + 7{\cdot}5O_2$. The factor obtained when H_2O_2 is in excess agrees with that obtained iodometrically, and unlike the factor obtained when $KMnO_4$ is in excess, is independent of the concn. of the reactants. F. R. G.

Determination of ferric iron in pharmacopœial preparations by the mercurous nitrate method.—See B., 1942, III, 220.

Rapid colorimetric determination of iron in aluminium alloys.—See B., 1942, I, 433.

Sensitivity of detection by spectrum analysis of alloying elements in steel and iron.—See B., 1942, I, 428.

Titrations with chromous salt solutions. I. Apparatus for chromometric titration. R. Flatt and F. Sommer (*Helv. Chim. Acta*, 1942, **25**, 684—694).—An apparatus for electrometric titrations with $CrSO_4$ and $CrCl_2$ in the complete absence of O_2 is described. The methods of producing O_2-free CO_2 and N_2 and the electrolytic reduction processes for preparing 0·1N-$CrSO_4$ and -$CrCl_2$ are detailed. These solutions are fairly stable in the absence of O_2. Titration curves with $CuSO_4$, W^{VI}, Fe^{III}, Ti^{IV}, and Mo^{V} and mixtures of these compounds are given. J. W. S.

Potentiometric series titrations of tungsten and molybdenum compounds in presence of vanadium and iron. W. D. Treadwell and R. Nieriker (*Helv. Chim. Acta*, 1941, **24**, 1098—1105).—When a mixture of H_2WO_4 and HVO_3 in M-H_3PO_4 is reduced in a Cd reducer and titrated potentiometrically with $KMnO_4$ in an atm. of N_2 the potential jumps are indistinct until V^{II} is oxidised to V^{IV} and W^{V} to W^{VI}, but the $KMnO_4$ required to cause potential change from 0·600 to 1·030 v., *i.e.*, to oxidise V^{IV} to V^{V}, can be determined accurately and hence the concns. of W and V can be calc. Mixtures containing H_2MoO_4 and HVO_3 in M-H_2SO_4 or -H_3PO_4 can be reduced to Mo^{IV} and V^{II} and analysed similarly. In the presence of W, V can also be determined by allowing the reduced solution to oxidise in air until the deep blue colour of W^{V} phosphate disappears and then titrating the V^{III} with $KMnO_4$ in an atm. of N_2. Fe^{II} does not inter-

fere with the potentiometric titration of W in a solution reduced in the Cd reducer, the break at 0·200 v. indicating complete oxidation to W^{VI}. The W^{V} phosphate can also be titrated directly with $KMnO_4$ or $FeCl_3$, the disappearance of the blue colour being taken as the end-point. J. W. S.

Analytical use of 3-hydroxybenzthiazole. H. Erlenmeyer and E. H. Schmid (*Helv. Chim. Acta*, 1941, **24**, 1159—1162).—Unlike 8-hydroxyquinoline, 3-hydroxybenzthiazole (**I**) forms no insol. compounds with $TiO^{··}$, $V_2O_7^{''''}$, MoO_4'', or WO_4'' and hence can be used for the determination of various cations in presence of these ions. For the determination of $Ni^{··}$ or $Zn^{··}$ in the solution is treated with NH_4Cl and NH_3 and 4% (**I**) in MeOH is added in slight excess. The mixture is heated on the water-bath for 10 min. and the remaining MeOH removed by careful reduction of pressure. After keeping for 1 hr. the ppt. is separated, washed, and dried. It is then washed with C_6H_6 to remove excess of reagent and the residue is dissolved in warm 2N-HCl, treated with KBr, and titrated with 0·1N-$KBrO_3$. Examples of the determination of Ni and Zn in presence of $TiO^{··}$, V_2O_7'''', MoO_4'', and WO_4'' are given. J. W. S.

Ozone as an analytical reagent. I. Determination of vanadium, cerium, and manganese. II. Determination of iodides. H. H. Willard and L. L. Merritt, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 486—489)—Mn (>9 mg.) is oxidised quantitatively to MnO_4' by O_3 in 1·16—2·32M-$HClO_4$ (not HNO_3, H_3PO_4, or H_2SO_4), using $AgNO_3$ as catalyst. Oxidation requires 15 min. when O_2 containing 5 wt.-% O_3 is used. Procedures for determining Mn in steel and Fe ore are given. Ce (>100 mg.) is oxidised to $Ce_3(PO_4)_4$ in 1 hr. by O_3 in dil. H_2SO_4 and H_3PO_4. $Ce_3(PO_4)_4$ separates as a white gel which is dissolved by H_2SO_4; the $Ce^{····}$ is titrated with $FeSO_4$. V in Cr–V and Cr–V–W steels can be determined after oxidation to H_3VO_4 by O_3. I′, SeO_3'', TeO_3'', NO_2', PO_2''', PO_3''', $Hg^{·}$, As''', and Sb''' are oxidised by O_3. Cr''' and Br′ are partly oxidised. L. S. T.

Rapid detection of gold by the electrographic method. J. A. Calamari, R. Hubata, and P. B. Roth (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 535).—Filter-paper moistened with $NaNO_3$–H_2O_2 is placed on the test metal (anode) and a graphite cathode applied to the paper. With an e.m.f. of 6—9 v. a purple stain appears on the paper if Au is present. The method detects Au in many alloys, but not very thin Au plate on Cu or brass. Cr gives a transient blue spot, V a red, and Ag a black spot. L. S. T.

Spectro-docimastic analysis. P. Pardo (*Anal. Fis. Quim.*, 1941, **37**, 321—323).—Docimastic technique for determination of Au and Ag is supplemented by spectrophotometric determination of Pt, Pd, Ru, and Ir. F. R. G.

XI.—APPARATUS ETC.

Attenuated superconductors. I. For measuring infra-red radiation. D. H. Andrews, W. F. Brucksch, jun., W. T. Ziegler, and E. R. Blanchard (*Rev. Sci. Instr.*, 1942, **13**, 281—292).—By means of a coil of fine W wire at 3·22—3·23° K., use is made of the large temp. coeff. of change of resistance of a superconductor between the superconducting and normal conducting states. The instrument described permits measurement of the infra-red flux between 50 and 120 μ. with a limit of accuracy of $\sim 10^{-3}$ erg sec.$^{-1}$ A. A. E.

Photometric performance of optical systems at low luminosities. J. M. Otero de Navascués and A. Durán Miranda (*Anal. Fis. Quim.*, 1941, **37**, 459—477).—A survey of the effect of the geometrical and physiological properties of the eye and loss of luminosity by reflexion on the performance of telescopic systems. F. R. G.

Measurement of the depth of ultra-microscopic objects. H. O. Müller (*Kolloid-Z.*, 1942, **99**, 6—28).—A method is given for determining the depth of objects from measurements of photographs obtained with a stereoscopic electron microscope. C. R. H.

Improved *X*-ray tube for diffraction analysis. R. R. Machlett (*J. Appl. Physics*, 1942, **13**, 398—401).—Thin sheets of Be, made malleable by the addition of a very small amount of Ti, are used for windows in the metal wall of an *X*-ray tube, thus enabling greater beam intensity and a purer spectrum to be obtained. A. J. M.

Maximum photometric contrast and its application to the technique of radiography of metallic substances. Determination of the size of internal defects of homogeneity. M. Abbad and L. Rivoir (*Anal. Fis. Quim.*, 1941, **37**, 419—441).—A graphical method is developed to obtain the optimum time (t') of exposure to give max. contrast in terms of the blackening of a plate due to *X*-rays (S_r) and of the background S_f in time t_0 according to $t' = t_0[\log (S_r/S_f)]/(S_r - S_f)$. A formula is deduced for determining the size of pores and other defects of homogeneity. F. R. G.

Radiography by reflexion. A. Guinier and J. Devaux (*Compt. rend.*, 1942, **214**, 223—225).—*X*-Ray photographs by reflexion, using long-λ *X*-rays, have been obtained. The val. of the method of radiography by reflexion depends on the different reflexion of *X*-rays from various elements in the surface to be examined, and the fact that the effect varies with the λ of the *X*-rays. The use of *X*-rays of different $\lambda\lambda$ to investigate the same surface extends the possibilities of this method. A. J. M.

Iron–iron oxide electrode for acid–base potentiometric titrations and for H-ion concentration determination. B. R. Agarwal and J. B. Jha (*J. Indian Chem. Soc.*, 1942, **19**, 76—78).—The electrode was prepared by oxidising with HNO_3 mild steel wire or Fe deposited electrolytically on Pt wire. Satisfactory results were obtained in acid solution. D. F. R.

Simplified dropping mercury electrode for polarographic analysis. R. C. McReynolds (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 586—587). L. S. T.

Dropping mercury electrode. G. J. Kahan (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 549). L. S. T.

Apparatus for determination of soluble bromide. J. Ehrlich (*Trans. Faraday Soc.*, 1942, **38**, 389—391).—A cell for the electrometric determination of Br′ is described. The chain Pb (5% amalgam)|$PbSO_4$|1M-$MgSO_4$|solution|AgBr|Ag gives reproducible results. The method is applicable to the examination of photographic emulsions and washings. F. L. U.

Testing of magnetic materials using a cathode-ray oscillograph with electrostatic deflexion only. K. Kreielsheimer (*J. Sci. Instr.*, 1942, **19**, 137—139).—A method is described, and formulæ are derived, for determining induction, field strength, and losses. A. A. E.

Detection of free radicals by the mass-spectrometer.—See A., 1942, **II**, 341.

Surface replicas for use in the electron microscope. V. J. Schaefer and D. Harker (*J. Appl. Physics*, 1942, **13**, 427—433).—Films of polyvinyl formal resin from 500 to 750 A. thick are formed on the surface by evaporation of a solution and are stripped off under H_2O. Similar films may be used for mounting specimens for observation by the electron microscope. O. D. S.

Electron microscope.—See B., 1942, I, 395.

High-intensity neutron source. M. Morand (*Rev. Sci. Instr.*, 1942, **13**, 301).—By means of a pump having a pumping speed of 1·3 cu. m. per sec. for H_2 an ion current of 5 ma. at ~40 kv. has been obtained. The reaction D + Be affords a neutron source of considerable intensity. A. A. E.

Apparatus for micro-determination of carbonates. G. H. Wyatt (*Analyst*, 1942, **67**, 260—261).—An absorption train constructed from a Schrötter apparatus and other standard components is described. S. B.

High-speed rotational viscosimeter of wide range. Confirmation of the Reiner equation of flow. H. Green (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 576—585). L. S. T.

Simple viscosimeter. F. C. Croxton (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 593—595). L. S. T.

Capillary viscosimeter to measure viscosities in excess of 10 poises.—See B., 1942, I, 394.

Glass-to-metal seals.—See B., 1942, I, 435.

Electromagnetic densitometer. A. R. Richards (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 595—596).—ρ for liquids can be determined with a precision of 1 in 800 for ρ between 0·62 and 0·82 g. per ml. L. S. T.

Fractionation of colloidal systems. Selection of operating conditions for the supercentrifuge. G. Fancher, S. C. Oliphant, and C. R. Houssiere, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 552—554). L. S. T.

Compensation method for determining micelle size. E. M. G. Laguarta (*Kolloid-Z.*, 1942, **99**, 85—89).—Micelle size is calc. from the extent of Brownian movement which can be ascertained by superimposing a measurable translational velocity which balances the Brownian movement. C. R. H.

Simple rubber stopper economiser. R. C. Peter (*Chem. and Ind.*, 1942, 383).—A glass plate with a central hole for a small rubber stopper may be used in place of a large rubber bung for vac.-distillations from a bolt-necked flask. H. G. R.

Injection and sampling stopcock [for gas analysis]. E. H. Brown (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 551). L. S. T.

Large-capacity metal stopcock. J. Bannon (*J. Sci. Instr.*, 1942, **19**, 140).—A compact stopcock which combines large pumping capacity with great reliability is sealing in described and figured. A. A. E.

Graphic method of studying the separation of mixtures by immiscible solvents. L. F. Knudsen and D. C. Grove (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 556—557).—A graphical procedure is described by which it is possible to predict the ratio of the vols. of solvents and the no. of funnels and separations required to give the best separation of the components of a mixture by the use of immiscible solvents. J. D. R.

Apparatus for continuous concentration of a solution under reduced pressure. B. L. Davis (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 548). L. S. T.

Simple hydrogen sulphide generator. B. W. Pocock, L. Scholten, and P. J. Erickson (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 575). L. S. T.

Pressure-measuring device for moderate vacua [0·05—2 mm.]. E. R. Kline (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 542). L. S. T.

Cleaning porcelain crucibles. J. E. D. Carwardine (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 533).—The crucible is placed in a dish of fused $KHSO_4$ for 5 min., cooled, and washed with hot H_2O. The glaze is not attacked. L. S. T.

Energy consumption in the Clusius separation tube when working continuously. H. Steinwedel (*Angew. Chem.*, 1942, **55**, 152—153).—An expression is obtained for the energy consumption of the Clusius tube for separation of gaseous isotopes. It is applied to the calculation of the heat expended in the separation of the Cl_2 isotopes. A. J. M.

Preparation of silver mirrors. P. de La Cierva and A. Durán (*Anal. Fis. Quím.*, 1941, **37**, 177—179).—A mirror reflecting 90% of the incident light and suitable for use in the Pulfrich photometer can be prepared by reducing $AgNO_3$ in NH_3 by glucose and CH_2O with a little HNO_3 and KOH in aq. EtOH. F. R. G.

" Perspex " in laboratory work. J. A. Radley (*Analyst*, 1942, **67**, 288).—Possible uses of " Perspex," polymerised Me methacrylate, are suggested. The resin has n_D 1·4896 (unplasticised optical quality), 1·4949 (normal commercial quality); thermal expansion $97·5 \times 10^{-6}$ per 1°; H_2O absorption after 24 hr. 0·4%; softens at 120°, may be moulded and will take an impression. It is unattacked by 10% HNO_3, 31% HCl, or 20% H_2SO_4 in 14 days at room temp. and is unaffected by many org. solvents and by saturated aq. NaOCl. S. B.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Bernhard Tollens, 1841—1918. C. A. Browne (*J. Chem. Educ.*, 1942, **19**, 253—259). L. S. T.

XIII.—GEOCHEMISTRY.

Difference in chemical composition between the base and the surface of the deep water-bearing horizon of Perly, Geneva canton. J. Buffle (*Arch. Sci. phys. nat.*, 1942, [v], **24**, *Suppl.*, 138—142).—Analyses (recorded) of samples of H_2O show an increase in mineralisation with depth, particularly in the alkaline-earth carbonates and nitrates; SO_4'' decreases at greater depths. These results are discussed. L. S. T.

Sediments of Grassy Lake, Villas Co., a large bog lake of northern Wisconsin. W. H. Twenhofel, S. L. Carter, and V. E. McKelvey (*Amer. J. Sci.*, 1942, **240**, 529—546).—The dry sediments contain 65—70% of org. matter which consists largely of a pale greenish-yellow gel in which are enmeshed detrital particles, diatom tests, sponge spicules, pollen grains, and vegetable matter. The greenish colour is attributed to chlorophyll. Chemical analyses are given. The max. thickness of the sediments, which have accumulated since the Ice Age, is 30 ft. 4 in., and since the H_2O content is ~95%, this reduces to 1·5 ft. of solid matter. The sediments contain oils with a yield by destructive distillation of 19 gals. per ton, and by extraction with Et_2O and $CHCl_3$, 5 and 8 gals. per ton, respectively. L. S. T.

Albite-schists of Antrim and their petrogenetic relationship to Caledonian orogenesis. D. L. Reynolds (*Proc. Roy. Irish Acad.*, 1942, **48**, **B**, 43—66).—Chemical analyses [Lady Gibbs] of biotite- and albite-schists and of gritty phyllites are recorded. The evidence of soda impregnation provided by the albite-schists, and the geochemical migration in orogenic belts, are discussed. L. S. T.

Quartz outcrops and their interpretation. B. Du Faur (*Chem. Eng. Min. Rev.*, 1942, **34**, 247—253).—The significance of outcrops in prospecting classification in respect of wall rock type is discussed, and examples of economic mineralisation underlying apparently barren exposed quartz are described. L. S. T.

Olivine-hypersthene-gabbros and -dolerites in Santal Parganas, Bihar. S. K. Ray (*Quart. J. Geol. Soc., India*, 1941, **13**, 103—163).—Rock-types, petrology, chemical and mineralogical changes are described, and chemical analyses recorded. L. S. T.

Merwinite as an artificial mineral. J. Phemister, with R. W. Nurse and F. A. Bannister (*Min. Mag.*, 1942, **26**, 225—230).—The orthosilicate $Ca_3Mg(SiO_4)_2$ was not recognised by Ferguson and Merwin (1919) in their study of the system CaO–MgO–SiO_2. It has since been found as a natural mineral in contact-altered limestone (Larsen and Foshag, 1921), in refractory bricks and blast-furnace slags, and it is prepared by heating the mixed oxides at 1500°. It melts incongruently at 1590°. In the slags it forms needles, plates, or irregular grains and is accompanied by melilite. It shows lamellar twinning and has α 1·708, β 1·714, γ 1·728, $2V$ 69°, positive. L. J. S.

Kalsilite, a polymorph of $KAlSiO_4$, from Uganda. F. A. Bannister, with M. H. Hey (*Min. Mag.*, 1942, **26**, 218—224).—This new mineral occurring as minute grains in potash-rich volcanic rocks was at first thought to be nepheline or kaliophilite, but although hexagonal and giving very close optical data it gives a much simpler *X*-ray pattern than these. The unit cell, a 5·17, c 8·67 A., contains $2KAlSiO_4$, and the space-group is $D_6^3 = C6_32$. Micro-analysis gave SiO_2 39·6, Al_2O_3 21·3, K_2O 20·1% etc. Sp. gr. 2·59, ω 1·542, ϵ 1·537. L. J. S.

Volcanic rocks from S.W. Uganda containing kalsilite (a polymorph of $KAlSiO_4$). A. Holmes (*Min. Mag.*, 1942, **26**, 197—217).—Eight detailed chemical analyses are given of lavas and ejected blocks from the Bunyaruguru volcanic field. They are ultra-basic (SiO_2 33·22—40·47%) rocks rich in K (K_2O 3·46—7·04%) and are named mafurite, ugandite, and katungite, of which several varieties (leucite-mafurite, melilite-ugandite, kalsilite-katungite, etc.) are distinguished according to the relative abundance of the constituent minerals. L. J. S.

Formula and systematic grouping of ekdemite and heliophyllite. H. Strunz (*Naturwiss.*, 1942, **30**, 89; cf. Sillén and Melander, A., 1942, I, 355).—The elementary cell of ekdemite, $Pb_3AsO_{<4}Cl_{<2}$, is analogous to that of nadorite. The metal at. lattices are similar but the O–Cl lattice is incomplete. O. D. S.

***X*-Ray studies on nadorite (ochrolite) $PbSO_2Cl$, and ekdemite.**—See A., 1942, I, 355.

New (?) phosphate–sulphate of aluminium from Utah. W. T. Schaller (*Amer. Min.*, 1940, **25**, 213).—A white scaly *mineral*, $2Al_2O_3,4SO_3,P_2O_5,24H_2O$, occurs in the Tintic Standard mine, Dividend, Utah, associated intimately with halotrichite, siderotile, and szomolnokite. It is readily sol. in cold H_2O; on warming, the solution gives a curdy white ppt. which redissolves on cooling. $24H_2O$ is retained at 105°. The mineral appears to be a new species, and not merely a variety of alunogen. L. S. T.

Rarer metallic constituents of some American igneous rocks. E. B. Sandell and S. S. Goldich (*Amer. Min.*, 1940, **25**, 213).—Cu, Pb, Zn, Co, Ni, and Mo have been determined in 31 samples from three igneous areas, and Co and Ni in 19 samples of the Keweenawan flows from the Michigan Cu district. L. S. T.

Crystal system and unit cell of acanthite, Ag_2S. L. S. Ramsdel (*Amer. Min.*, 1940, **25**, 212).—Weissenberg photographs indicate a monoclinic unit cell with a_0 4·20, b_0 6·93, c_0 9·50 A., and β 55°. L. S. T.

Isotypism of $PbK_2(SO_4)_2$ and $Ca_3(PO_4)_2$.—See A., 1942, I, 355.

Binary system albite ($NaAlSi_3O_8$)–sphene ($CaTiSiO_5$). A. T. Prince (*Amer. Min.*, 1940, **25**, 212).—The liquidus curve has been determined. L. S. T.

Binary system $NaAlSiO_4$–$CaSiO_3$. W. R. Foster (*Amer. Min.*, 1940, **25**, 207).—Equilibrium relations of the system carnegieite, nephelite-pseudowollastonite, wollastonite have been determined. L. S. T.

Spectrographic study of cinnabar [from twenty deposits]. R. M. Dreyer (*Amer. Min.*, 1940, **25**, 207).—Certain heavy metals, viz., Fe, Cr, Mn, Ag, Cu, Zn, Ni, Ge, Pb, and Co, are associated invariably with cinnabar (**I**) ores. Cu, Pb, Co, Ge, and Ag are conc. differentially, presumably in solid solution, and these concns. are independent of geographical or geological occurrence. The different shades of (**I**) coloration are independent of the elements conc. differentially in (**I**). L. S. T.

Structural crystallography and composition of jamesonite. L. G. Berry (*Amer. Min.*, 1940, **25**, 204).—Jamesonites from Cornwall and the Itos Mine, Bolivia, are identical (*X*-rays): a_0 15·68±0·05, b_0 19·01±0·05, c_0 4·03±0·01 A., β 91° 48′±30′; space-group $P2_1/a$, $\rho_{calc.}$ is 5·67, and $\rho_{obs.}$ 5·63. The unit cell is $2[4PbS,FeS,3Sb_2S_3]$. L. S. T.

Mineralogy and paragenesis of the variscite nodules from near Fairfield, Utah. I—III. E. S. Larsen, 3rd (*Amer. Min.*, 1942, **27**, 281—300, 350—372, 441—451).—The phosphate and other minerals occurring in or associated with the nodules are described. Weissenberg *X*-ray studies show that wardite, $CaNa_4Al_{12}(PO_4)_8(OH)_{16},6H_2O$, has a_0 7·04, c_0 18·88 A. (±0·02 A.); space-group C_4^2—$P4_1$ or C_4^4—$P4_3$, and gordonite, $MgAl_2(PO_4)_2(OH)_2,8H_2O$, a_0 5·25, b_0 10·49, c_0 6·97 A. (all ±0·02 A.), α 107° 20′, β 111° 12′, γ 72° 12′, probable space-group $P\bar{1}$—C_i^1. The paragenetic relations of the minerals are described, and the formation of variscite from phosphatic groundwaters reacting with aluminous material is discussed. L. S. T.

Mineralogical character and origin of pyrites in coal. E. Stach (*Z. Ver. deut. Ing. Beih. Verfahrenstech.*, 1941, 98—101).—Primary pyrites which is derived from melnikowite is dispersed in fine particles throughout the coal mass, mostly so fine as to be scarcely visible to the naked eye. The particles average 6—10 μ. in diameter and are composed of cubes of equal size but most irregularly grouped. Secondary pyrites fills the cracks and fissures in the coal and is formed later. R. B. C.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

DECEMBER, 1942.

I.—SUB-ATOMICS.

Spectrum of Cl I. J. B. Green and J. T. Lynn (*Physical Rev.*, 1942, [ii], **62**, 179).—From Zeeman effect measurements in the region λλ 3000—9200, new levels, lines, classifications, g vals., and g sums have been obtained. N. M. B.

Absence of the $M\beta$ X-ray satellite intensity anomaly. F. R. Hirsh, jun. (*Physical Rev.*, 1942, [ii], **62**, 137—140; cf. A., 1940, I, 276).—The absence of the $M\beta$ X-ray satellite intensity max. is shown, and explained in terms of the relative probability of Auger transitions, the relative probabilities being determined by diagram line widths. N. M. B.

Investigation of X-radiation from ^{121}Te (125 days) by critical absorption and fluorescence. R. D. O'Neal and (Mrs.) G. Scharff-Goldhaber (*Physical Rev.*, 1942, [ii], **62**, 83—84; cf. Seaborg, A., 1940, I, 186).—Results reported indicate the absence of an isomeric transition. The observed X-ray component harder than the Sb $K\alpha$ line is provisionally explained. N. M. B.

Proton production by electron collisions in molecular hydrogen. H. F. Newhall (*Physical Rev.*, 1942, [ii], **62**, 11—18).—With a mass spectrometer the " fast " protons (but not the slow protons) found by Bleakney (cf. A., 1930, 969) were observed. The cross-section for their production reached a max. of ~0·015 sq. cm. per c.c. for 110-v. electrons. The initial energy distribution of the ions, approx. calc. by Smith's theory (cf. A., 1941, I, 140), accords with the potential energy curves of H_2. N. M. B.

Mobilities in some free electron gases. W. H. Bennett and L. H. Thomas (*Physical Rev.*, 1942, [ii], **62**, 41—47; cf. A., 1941, I, 66).—Mobility coeffs. for free electrons and mobilities of positive ions are reported for H_2, D_2, and for H_2–N_2 and H_2–He mixtures for field strengths 1—2 v. per cm. per mm. of Hg gas pressure. The relation between free electron drift velocity and field strength is parabolic in this range for all the gases. Results can be explained qualitatively if electrons excite rotations of the H_2 mol. by collision, and the cross-sections for this process are estimated. N. M. B.

Mercury arc cathode. C. G. Smith (*Physical Rev.*, 1942, [ii], **62**, 48—54).—To explain the escape of electrons from the arc spot on the liquid cathode, yielding currents of ~4000 amp. per sq. cm., the theory is advanced that electronic bombardment of the cathode results in the transfer to conduction electrons of enough energy to heat them to ~4000° K. and to produce a thermionic emission yielding the observed arc current plus that coming down from the vapour, the at. configuration temp. being only ~150° C. The theory accords with ideas previously accepted and with known factors in the vapour above the arc spot, and appears to be the only theory compatible with the characteristic behaviour of the arc spot in a transverse magnetic field and with known extinction phenomena. The Thomson-effect heat apparently arrests most of the heat flow into the liquid along the vertical temp. gradient in the electronic part of the thermal conductor and is the factor causing the characteristic c.d. W. J.

Loss of energy of hydrogen ions in traversing various gases. C. M. Crenshaw (*Physical Rev.*, 1942, [ii], **62**, 54—57).—The loss of energy of H and D ions having initial energies 60—340 ke.v. was measured as a function of their path, in air, H_2O vapour, H_2, D_2, and He at various pressures. Results are expressible in terms of the energy loss in ke.v. per cm. of path per mm. of pressure as well as in terms of the stopping power relative to air. N. M. B.

Theory of the magnetron. II. Oscillations in a split-anode magnetron. L. Brillouin (*Physical Rev.*, 1942, [ii], **62**, 166—177; cf. A., 1941, I, 444).—Mathematical. N. M. B.

Theoretical values of the physical constants. (Sir) A. Eddington (*Proc. Physical Soc.*, 1942, **54**, 491—504).—Vals. calc. on recent theory show satisfactory agreement with those of Birge (*Rept. Progr. Physics*, 1942, **8**, 90). The inclusion of small corrections indicated by the theory eliminates the small discordance between the spectroscopic and deflexion vals. of e/m_0c and gives complete agreement of observation and theory. There should be no difference between the direct and indirect vals. of h/e. N. M. B.

International table of stable isotopes. F. W. Aston (*Nature*, 1942, **150**, 515).—The sixth report of the Committee on Atoms of the International Union of Chemistry covers He, S, Ni, Co, Mo, and Rh. A. A. E.

New packing fractions and the packing fraction curve. H. E. Duckworth (*Physical Rev.*, 1942, [ii], **62**, 19—28).—Descriptions of and data for a no. of mass comparisons, with other recent data, are critically analysed to obtain vals. for the packing fraction (f) curve. An f-at. no. curve suggests that f of an element with odd at. no. is algebraically > the average f of the two adjacent elements with even at. no. This implies that elements with even at. no. are more stable than those of odd at. no., and supports the theory that protons in the nucleus are associated together in groups of two. N. M. B.

Density of sodium chloride. At. wt. of fluorine by combination of crystal density and X-ray data. H. L. Johnston and D. A. Hutchison (*Physical Rev.*, 1942, [ii], **62**, 32—30).—Precise determinations, by the method of " crystal flotation " in pure $C_2H_4Br_2$, of highly purified NaCl crystals give $d^{20} = 2{\cdot}16366 \pm 0{\cdot}00003$ g. per ml. Combination with data for d of LiF and the lattice const. of LiF gives $0{\cdot}443640 \pm 0{\cdot}000025$ for the LiF/NaCl mol. wt. ratio. With 22·997 (International) for the at. wt. of Na, this ratio yields $18{\cdot}994 \pm 0{\cdot}001$ for the at. wt. of F; with 22·994 (Birge) for Na, the val. for F is 18·992. Results accord with $22{\cdot}995 \pm 0{\cdot}002$ based on densities and lattice consts. of fluorite and calcite, but are rather < the mass spectrograph val. $18{\cdot}999 \pm 0{\cdot}001$ for ^{19}F. N. M. B.

High-intensity neutron source.—See A., 1942, I, 378.

Inelastic scattering of neutrons by crystal lattices. R. J. Seeger and E. Teller (*Physical Rev.*, 1942, [ii], **62**, 37—40).—A discussion of the restrictions on inelastic scattering processes imposed by the crystal interference conditions. N. M. B.

Yield of neutrons from deuterons on carbon. C. L. Bailey, (Miss) M. Phillips, and J. H. Williams (*Physical Rev.*, 1942, [ii], **62**, 80; cf. Bonner, A., 1940, I, 383).—The excitation curve for the reaction $^2D + {}^{12}C \rightarrow ({}^{14}N)^* \rightarrow {}^{13}N + {}^1n$ studied in the range 0·70—2·75 Me.v. shows resonances at 0·91, 1·28, 1·6 (new), and 2·3 (prominent) Me.v. The total yield, the sharp decrease beyond the 2·3-Me.v. resonance, and the comparative proton yield from the reaction $^2D + {}^{12}C \rightarrow ({}^{14}N)^* \rightarrow {}^{13}C + {}^1p + Q$ are discussed. N. M. B.

Neutron–proton interaction. J. Schwinger (*Physical Rev.*, 1939, [ii], **55**, 235).—Consequences of the most general interaction not explicitly involving the particle momenta are examined by introduction of interaction terms of a new type. A. J. E. W.

Excitation functions of intermediate elements. E. J. Konopinski (*Physical Rev.*, 1939, [ii], **55**, 235).—The Breit–Wigner dispersion formula and the Gamow–Condon–Gurney theory of barrier penetration are applied to excitation functions of reactions involving elements with mass-nos. = 10—30. Except in favourable cases [*e.g.*, ^{12}C (d,n) ^{13}N] the method is limited by uncertainties in the no. and wt. of possible residual states. A. J. E. W.

Low-energy scattering of protons by protons. H. M. Thaxton (*Indian J. Physics*, 1942, **16**, 133—137).—Theoretical calculations for the analysis of the experimental data of Ragan *et al.* (cf. A., 1942, I, 78) are derived. Phase shifts are determined, and Mott-ratio curves and S-wave scattering effects are given for potential wells. W. R. A.

Experiments on the F + ^{1}H γ-radiation and the Klein–Nishina absorption coefficient at 5·7 Me.v. J. Halpern and H. R. Crane (*Physical Rev.*, 1939, [ii], **55**, 236—237).—The distribution of recoil electrons ejected from 1·5 mm. of C by γ-radiation from F (as CaF_2) and protons shows that this radiation is monochromatic at ~5·7 Me.v. ·4-Me.v. electrons (cf. A., 1937, I, 592) are negative members of internal conversion pairs. The Klein–Nishina absorption of the γ-radiation in 10 cm. of Al is in good agreement with theory. A. J. E. W.

Fine structure of nuclear energy levels on the α-model. C. Kittel (*Physical Rev.*, 1942, [ii], **62**, 109—117).—An investigation of the extent to which the fine-structure predictions of any proposed theory of nuclear forces are sensitive to the changes in the nuclear model. The α- and central-field models, with a deuteron group model and simple α group for the α-particle, are applied to the splitting of ^{5}He and ^{7}Li. N. M. B.

Properties of the radio-element $^{32}_{15}P$ obtained by bombardment of sulphur by slow neutrons. M. D. de Souza Santos and A. de Moraes (*Anais Assoc. Quím. Brasil*, 1942, **1**, 79—87).—Results agree with those of earlier workers. F. R. G.

Characteristic radiations of ^{60}Co. M. E. Nelson, M. L. Pool, and J. D. Kurbatov (*Physical Rev.*, 1942, [ii], **62**, 1—3; cf. Livingood, A., 1938, I, 381).—The 10·7-min. activity produced by Co (n, γ) and Ni (n, p) reactions is produced with a far higher intensity by a Co (d, p) reaction. The β-ray spectrum is continuous with end-point $1{\cdot}35\pm0{\cdot}1$ Me.v., and each β-ray is accompanied by $\sim$1 γ-ray of $1{\cdot}5\pm0{\cdot}2$ Me.v. energy. The 5·3-year activity (cf. Risser, *ibid.*, 8) emits a $1{\cdot}7\pm0{\cdot}2$-Me.v. γ-ray and a 220 ± 20-ke.v. β-ray spectrum. ^{60}Co may consist of isomeric nuclei in which the two activities decay independently. N. M. B.

Disintegration schemes of radioactive substances. IV. ^{59}Fe. M. Deutsch, J. R. Downing, L. G. Elliott, J. W. Irvine, jun., and A. Roberts (*Physical Rev.*, 1942, [ii], **62**, 3—7; cf. Livingood, A., 1938, I, 427).—^{59}Fe (47 days) emits a complex β-ray spectrum consisting of two components of approx. equal intensity with end-points $0{\cdot}257\pm0{\cdot}008$ and $0{\cdot}460\pm0{\cdot}007$ Me.v., accompanied, respectively, by γ-rays of energy $1{\cdot}30\pm0{\cdot}02$ and $1{\cdot}10\pm0{\cdot}02$ Me.v. The yield of ^{59}Fe from an Fe target bombarded by 12-Me.v. deuterons is 0·05 μ-curie per μ-amp. hr. Purification and prep. are described. N. M. B.

Excited states of nuclei beyond oxygen. A. Guthrie and R. G. Sachs (*Physical Rev.*, 1942, [ii], **62**, 8—10; cf. Wigner, A., 1937, I, 440).—The difference in energy of the ground states and excited states of the same symmetry is expected to vary smoothly as a function of mass no. Available data on the excited states of ^{20}Ne, ^{24}Mg, ^{28}Si, ^{32}S, ^{36}A, and ^{40}Ca do not disagree with this behaviour. N. M. B.

Energy of γ-rays accompanying the decay of ^{7}Be. I. Zlotowski and J. H. Williams (*Physical Rev.*, 1942, [ii], **62**, 29—32; cf. Roberts, A, 1938, I, 427).—Coincidence counter measurements on the absorption of secondary electrons produced by the γ-rays accompanying the decay of ^{7}Be give $0{\cdot}77\pm0{\cdot}03$ for the max. range in Al and $0{\cdot}86\pm0{\cdot}04$ mm. for the γ-rays from the annihilation of ^{13}N positrons (used for calibration). The energy of the ^{7}Be γ-ray is $0{\cdot}485\pm0{\cdot}005$, assuming 0·510 Me.v. for the ^{13}N γ-rays. The agreement with the low-excited level of ^{7}Li (0·475 Me.v.), deduced from other reactions, confirms the view that the observed ^{7}Be γ-rays originate from this excited state of ^{7}Li which is created by electron capture. N. M. B.

β-Ray spectra of ^{86}Rb, ^{89}Sr, ekatantalum, and protactinium. (Miss) E. Haggstrom (*Physical Rev.*, 1942, [ii], **62**, 144—150).—The theory of, and improvements to, a β-ray spectrograph are reported (cf. Witcher, A., 1941, I, 390). β-Ray spectral curves for the above four elements are given. The upper energy end-points are: ^{86}Rb $1{\cdot}60\pm0{\cdot}03$, ^{89}Sr $1{\cdot}32\pm0{\cdot}03$ Me.v., ekatantalum 230 ke.v. The Fermi and Konopinski–Uhlenbeck plots of ^{86}Rb and ^{89}Sr are given. N. M. B.

Cross-section measurements for disintegrations produced by deuterons in the heavy elements. R. S. Krishnan and E. A. Nahum (*Proc. Roy. Soc.*, 1942, **A, 180**, 321—332).—Cross-sections have been measured for reactions produced by deuterons of 9 Me.v. energy in Pt, Au, Hg, Tl, Pb, Bi, Th, and U. The experimental results are consistent with a standard nuclear radius of $1{\cdot}47\times10^{-13}$ cm. G. D. P.

Excitation function measurements for disintegrations produced by deuterons in the heavy elements. R. S. Krishnan and E. A. Nahum (*Proc. Roy. Soc.*, 1942, **A, 180**, 333—345).—Measurements were made, using deuterons up to 9 Me.v. energy, for the (d, p) reaction in Tl, Pb, Bi, and Th, and for the (d, n) reaction in Tl and Bi. The energy–yield curves are compared with those expected on theoretical grounds. The excitation function for (d, n) is approx. that predicted by the Gamow penetration theory; the (d, p) reaction occurs mainly by the Oppenheimer–Phillips process. G. D. P.

K-Electron capture in ^{106}Ag. J. R. Richardson (*Physical Rev.*, 1939, [ii], **55**, 236).—45% of the electrons emitted by ^{106}Ag (cf. Pool, A., 1938, I, 113) occur in a narrow energy (E) band at <17 kv., and are Auger electrons and photoelectrons associated with K-electron capture. Electrons with $E>20$ kv. (max. 800 kv.) are due to the internal conversion process; a similar E distribution is given by photoelectrons ejected from a Pb lamina by γ-radiation. A. J. E. W.

Evidence for the existence of associated mesons in cosmic-ray showers. M. S. Sinha and R. L. Sengupta (*Indian J. Physics*, 1942, **16**, 129—131).—Using a counter-controlled Wilson chamber, which recorded showers only, evidence of the existence of associated mesons has been obtained. W. R. A.

Anomalous scattering of mesons. W. Heitler and H. W. Peng (*Physical Rev.*, 1942, [ii], **62**, 81—82; cf. Code, A., 1941, I, 190; Shutt, A., 1942, I, 162).—Scattering theory is discussed and available experimental data are shown to accord with calculations. N. M. B.

Radioactive decay of slow mesons. M. D. de Souza Santos (*Ann. Acad. Brasil Sci.*, 1942, **14**, 199—201).—A preliminary account of a counter investigation (see following abstract). The decay curve resembles that of a Gauss distribution and the rate of disintegration is different from that for β-rays. F. R. G.

Decay of slow mesons. M. D. de Souza Santos (*Physical Rev.*, 1942, [ii], **62**, 178—179).—The disintegration electron intensity was measured at different time intervals, by means of a variable time delay coincidence set, after the mesons came to rest. The curve is symmetrical about $t_0 = 5\times10^{-6}$ sec., and differs entirely from the curve to be expected from radioactive disintegration laws. N. M. B.

Meson theory and the magnetic moments of protons and neutrons. H. Fröhlich (*Physical Rev.*, 1942, [ii], **62**, 180).—Calculations on anomalous magnetic moments favour a vector- and pseudoscalar-meson theory rather than a purely pseudoscalar-meson theory. N. M. B.

Electromagnetic properties of nuclei in the meson theory. S. T. Ma and F. C. Yu (*Physical Rev.*, 1942, [ii], **62**, 118—126).—Mathematical. Pauli's treatment for a free meson is generalised to include nuclear particles. N. M. B.

Pseudoscalar meson field with strong coupling. W. Pauli and S. M. Dancoff (*Physical Rev.*, 1942, [ii], **62**, 85—108).—Mathematical. A treatment of the symmetrical and charged pseudoscalar theories of the meson field, using the strong-coupling approximation, and restricted to the case of a single source. The energy levels of the excited states of the heavy particle, the scattering cross-section for free mesons, and the magnetic moment of the proton or neutron are computed. N. M. B.

Tensor forces and heavy nuclei. G. M. Volkoff (*Physical Rev.*, 1942, [ii], **62**, 126—133; cf. Rarita, A., 1941, I, 236, 289; Bethe, A., 1940, I, 190).—A rough quant. estimate is made of the relative contributions of the central force term and the tensor term to the binding energy of a nucleus on the basis of a highly simplified nuclear model. Consequences are discussed. N. M. B.

Exchange tensor forces in heavy nuclei. G. M. Volkoff (*Physical Rev.*, 1942, [ii], **62**, 134—136).—If tensor forces, whether of the ordinary or the exchange type, are assumed to be the dominant forces between nuclear particles, they will not lead to saturation, but will permit the existence of nuclei with excessive vals. of binding energy, spin, and isotopic no. A sufficiently strong spherically symmetrical exchange term in the nuclear interaction seems to be required to counteract this effect of the tensor forces. N. M. B.

Theory of particles of spin half and the Compton effect. H. J. Bhabha and D. Basu (*Proc. Indian Acad. Sci.*, 1942, **15, A**, 105—117, 461—463).—(A) It is shown that, contrary to general acceptance, the original Dirac theory, in which a particle of spin $\hbar/2$ is represented by the Dirac equation with all the negative energy states empty, and the hole theory, in which each of these states is filled by an electron, do not in general lead to the same probabilities for second-order processes (taking place in nature in two steps through an intermediate state), although the matrix elements for each first-order process are the same. The formula for scattering of radiation by a free electron is not the same on the hole theory as on the original Dirac theory (the Klein–Nishina formula); the two agree only for low light-quantum energies; for high energies the Klein–Nishina alone agrees with scattering experiments. The hole theory, which qualitatively describes the existence of the positron and the pair-creation process, is, however, the only form in which the Dirac theory is logically tenable.

(B) Erratum. The former conclusion is erroneous, and the two theories give the same probabilities for second-order processes. W. J.

II.—MOLECULAR STRUCTURE.

New band-system of boron monoxide. N. L. Singh (*Current Sci.*, 1942, **11**, 277—278).—A new BO system has been observed at 5110—5790 A. in the spectra of a spark between glass electrodes and a Bunsen flame fed with H_3BO_3. The band-heads are given by $\nu = 21005{\cdot}6 + (1200v' - 15{\cdot}4v'^2) - (1266v'' - 10v''^2)$. The system is related to the β-system of ^{11}BO, and gives a new electronic level at 63870·8 cm.$^{-1}$ (7·9 e.v.). The new bands always accompany the "B_2O_2 bands" (which are also ascribed to BO) and afford a more sensitive means of detection of B than the *raies ultimes*. The initial state of the new system is probably a quartet Σ state arising from B $(2s^22p^2\ ^4P)$ and O $(2s^22p^4\ ^1D)$, which is reached directly on formation of BO from B_2O_3. A. J. E. W.

Perturbations causing apparent convergence in the C_2 spectrum. L. Gerö and R. F. Schmid (*Physical Rev.*, 1942, [ii], **62**, 82—83).—Experimental data on perturbations in $^1\Pi \rightarrow {}^1\Pi$ bands amplifying the results of rotational analysis by Herzberg (cf. A., 1940, I, 281) are outlined. N. M. B.

Energy of dissociation of carbon monoxide. A. G. Gaydon and W. G. Penney (*Nature*, 1942, **150**, 406—407).—From a review of spectroscopic evidence it appears that D of CO lies between 9·85 and 11·11 e.v., and that all lower vals. proposed are improbable. D of N_2 is $\sim$ 9 e.v. W. J.

Absorption spectra of CdF and SnCl. C. A. Fowler, jun. (*Physical Rev.*, 1942, [ii], **62**, 141—143).—CdF_2, vaporised in an electric furnace, shows no absorption in λλ 1950—7000 below 1350°, but above this temp. a band system of CdF appears at λλ 2716—2924, and strong continuous absorption at higher temp. The spectrum of SnCl, photographed in absorption for the first time, consists of the two emission band systems, a new system in the farther ultra-violet, and two continua. Its similarity to the SnF absorption spectrum is discussed. N. M. B.

Force constants and internuclear distances. G. Glockler and G. E. Evans (*J. Chem. Physics*, 1942, **10**, 606).—Application of Badger's rule (A., 1934, 477) to hydrides of the elements of the first row of the periodic table gives results for force consts. in good agreement with those obtained from spectroscopic data. A. J. M.

Luminous radiation from hot gases. W. T. David (*Nature*, 1942, **150**, 291—292).—Evidence that normal gases, *e.g.*, CO_2, remain non-luminous at high temp. is reviewed. A. A. E.

Abnormality of flame gases. W. T. David (*Nature*, 1942, **150**, 320—321).—Gaydon's view that mols. of CO_2 in residual flame gases suffer rapid transition to the ground state and are left in a highly vibrationally excited state is contested. The abnormal structure hypothesis, and the assumption that the mols. reach the ground state only when they come in contact with a surface or when two of them possessing sufficient energy collide, are preferred. A. A. E.

Vibration–rotation spectrum of (A) SiH_4, (B) GeH_4. C. H. Tindal, J. W. Straley, and H. H. Nielsen (*Physical Rev.*, 1942, [ii], **62**, 151—160, 161—165).—(A) The infra-red bands of SiH_4 have been remeasured at high resolving power. Full data, identifications, and analyses are given, and vals. of consts., band centres, and valency force consts. are reported.

(B) Corresponding measurements and data for GeH_4 are reported. A new band near 13·0 μ., with centre $\nu_4 = 819{\cdot}3$ cm.$^{-1}$, has been found. N. M. B.

Influence of barrier dimensions on the vibrational spectrum of ethane. A. Charlesby (*Proc. Physical Soc.*, 1942, **54**, 471—487).—Mathematical. The effect on the energy levels of a rectangular potential barrier is investigated. A barrier of height $V = 1700$ g.-cal. per mol. and width 1·35 radians gives energy levels substantially similar to those predicted by a sinusoidal barrier of height 3000 g.-cal. per mol. The effect of splitting in the energy levels is slight for levels below V, and considerable for those above V. The energy levels for C_2D_6 are deduced. N. M. B.

Vibration–rotation energies of planar ZXY_2 molecules. I. Vibrational modes and frequencies. S. Silver and E. S. Ebers. **II. Quantum-mechanical Hamiltonian and the energy values.** S. Silver (*J. Chem. Physics*, 1942, **10**, 559—564, 565—574).—I. Mathematical. The normal modes and frequencies of planar ZXY_2 mols. are investigated, using the most general potential function possible.

II. Mathematical. Nielsen's method (A., 1942, I, 131) for vibration–rotation energies of a general polyat. mol. is applied to planar ZXY_2 mols. A. J. M.

Near ultra-violet absorption spectrum of monodeuterobenzene. C. A. Beck and (Miss) H. Sponer (*J. Chem. Physics*, 1942, **10**, 575—581).—The near ultra-violet absorption spectrum of PhD in the region 2300—2650 A. has been analysed. The system has a great no. of weak bands and is due to a forbidden transition, which is permitted by the 603 vibration (corresponding to the 606 ϵ^+_g vibration in C_6H_6). The 0, 0 band is very weak and occurs at 38124 cm.$^{-1}$ Many of the bands are double-headed. A. J. M.

Internal rotation in molecules with two or more methyl groups. K. S. Pitzer (*J. Chem. Physics*, 1942, **10**, 605—606).—Thermodynamic data alone do not give definite information concerning cross-terms in the internal rotation potential energy of mols. with two or more Me groups. They should be combined with spectroscopic data. A. J. M.

Light absorption of polycyclic compounds. II. Cupric complexes of the aldimine series. A. von Kiss, G. Bácskai, and P. Csokán (*J. pr. Chem.*, 1942, [ii], **160**, 1—20).—Extinction curves, 200—700 mμ., at room temp., are recorded for a no. of polycyclic inner-complex Cu^{II} salts and their constituents. F. J. G.

Light absorption of polycyclic inner-complex compounds. III. Uranyl complexes of the aldimine series. A. von Kiss and G. Nyiri (*Z. anorg. Chem.*, 1942, **249**, 340—356).—Extinction curves (200—700 mμ. at room temp.) are recorded for a no. of polycyclic inner-complex uranyl salts. F. J. G.

Absorption spectra of compounds containing sulpho-groups. H. Böhme and J. Wagner (*Ber.*, 1942, **75**, [*B*], 606—617).—Comparison of the absorption spectra of $SO_2Me{\cdot}CH(SO_2Et)_2$ in H_2O and in an excess of 0·1N-NaOH and of $SO_2Me{\cdot}CMe(SO_2Et)_2$ shows that electrolytic dissociation causes a slight displacement towards the red. The absorption of $NH(SO_2Me)_2$ and $NMe(SO_2Me)_2$ is very slight and little characteristic. The absorption of PhSH with two pairs of lone electrons at S is more marked than that of PhOH, $PhSO_3H$ (I), $PhSO_2H$ (II), or C_6H_6 and has pronounced bands at 237 mμ. and 260—270 mμ. This latter band is present in the spectra of (I), (II), and PhOH, and appears to be due to displacement towards the red and increase in intensity of the characteristic C_6H_6 bands. (I) shows the three strongest C_6H_6 bands probably because all electrons of S are bound in SO_3H, and the saturated atom, like the Me group, has little influence on the absorption in the ultra-violet of medium and longer λ but causes essentially displacement towards the red and increase of intensity. (I) and $PhSO_3Na$ have very similar spectra. $PhSO{\cdot}NH_2$ resembles (II) in spectrum in acid but not in neutral or alkaline solution. $PhSO_2{\cdot}NH_2$ shows bands similar in position to those of (I) but the intensity is nearly doubled. In alkaline solution the absorption bands have completely disappeared. Similar observations are made with $NHAc{\cdot}SO_2Ph$. H. W.

Absorption spectra and *X*-ray examination of isomeric gluconononitriles. P. E. Papadakis (*J. Amer. Chem. Soc.*, 1942, **64**, 1950—1953).—The two forms of gluconononitrile, *A* and *B*, m.p. 145° and 120·5°, exhibit the same *X*-ray powder diffraction spectra but different ultra-violet absorption spectra and optical activities. Aq. solutions of the *B* form have an absorption band at 2780 A. and an extinction coeff. given by $\log \varepsilon_{molar} = \sim 0{\cdot}9$. The ultra-violet spectrum also undergoes complex changes with time. The *A* form shows no absorption max. at λ 2780 A. and has a spectrum similar to that of $OH{\cdot}[CH_2]_2{\cdot}CN$. The band at 2780 A. is probably caused by several cyclic compounds containing CO or NH groups, derivable from the nitrile. Interconversion of these compounds may be responsible for the changes with time in the details of the characteristic band, and for the changes in optical rotation as well as for other spectral changes in the short-λ ultra-violet. A gradual hydrolysis of the *B* form would not account for some facts, and degradation by loss of HCN is inconsiderable. The possibility that the two cryst. forms *A* and *B* differ in the nature of the H-bonding is discussed. W. R. A.

Ultra-violet absorption spectra of nitrogenous heterocyclic [compounds]. IV. Effect of p_H and irradiation on the spectra of *iso*guanine and 6 : 8-diamino-2-hydroxypurine. (Miss) M. M. Stimson (*J. Amer. Chem. Soc.*, 1942, **64**, 1604—1605).—Substitution of OH in 6-amino-pyrimidine causes $\lambda_{max.}$ to shift to shorter λλ as p_H rises and $\varepsilon_{max.}$ to rise at p_H 7 and then fall at p_H 11·0 to a val. < that at p_H 3. In 2-hydroxy-purines and -pyrimidines $\varepsilon_{max.}$ is reduced at p_H 7. The addition of another NH_2 to give 6 : 8-diamino-2-hydroxypurine shows a similar but smaller p_H effect on $\lambda_{max.}$. On irradiation adenine shows negligible change but *iso*guanine shows a marked change in extinction. W. R. A.

Structure of proteins. P. Csokán and K. Laki (*Z. physikal. Chem.*, 1942, **A, 190**, 278—286).—Under the action of thrombin, fibrinogen albumin from pig's blood in a PO_4''' buffer gives a transparent fibrin, the absorption of which has been investigated over the λ range 2000—5000 A. and compared with the absorption of fibrinogen, turbid fibrin, thyrosin, and tryptophan. The results suggest that the change from fibrinogen to fibrin occurs through the formation of H-bridges. J. W. S.

Preparation and properties of *peri*-hydroxyquinone inner complexes. See A., 1942, II, 410.

Effect of polarised light on the absorption spectrum of the neodymium ion in crystals. E. L. Kinsey and R. W. Krueger (*Physical Rev.*, 1942, [ii], **62**, 82).—A preliminary report and explanation of results for $Nd(BrO_3)_3{\cdot}9H_2O$ near 5750 A. as influenced by the state of light polarisation. N. M. B.

Isomers of crystal-violet ion. Their absorption and re-emission of light. G. N. Lewis, T. T. Magel, and D. Lipkin (*J. Amer. Chem. Soc.*, 1942, **64**, 1774—1782).—The absorption of light by crystal-violet (I) has been studied under varying conditions and in numerous solvents. Solvents appear to be of three kinds, typified by EtOH, $CHCl_3$, and PhMe, with respect to the absorption curves. All three types of curve show two absorption bands, *A* and *B*. In EtOH the curve is independent of every isothermal change; the relative height of the *B* band decreases with diminishing temp., and the two bands belong to two isomerides of (I) ion, A and B, of which B has the higher energy by 580 g.-cal. A theory as to the nature of these stereoisomerides, supported by experiments at low temp. on the absorption curve of malachite-green, is put forward. There is no appreciable no. of free ions in solvents of classes II and III (all of low dielectric const.), but rather ion clusters as described by Fuoss and Kraus (A., 1934, 1304). With increasing concn. of dye, small changes occur in the curves of class III and a remarkable change in the $CHCl_3$ curve due to a salt effect which can be duplicated by adding other salts; these salt effects are much greater than in any other known cases. The fluorescent and phosphorescent emission from (I) is studied quantitatively. As for fluorescein, visible light of high intensity converts most of (I) into the phosphorescent state so as to change the absorption spectrum considerably. The phosphorescent state gives α and β bands in the red and infra-red. The heat of activation from the phosphorescent to the fluorescent state is only 5·8 kg.-cal. A new phosphorescent state is produced with ultra-violet light giving a green emission band. All the phosphorescence

and fluorescence are attributed to isomeride A. Still another isomeric condition of (I) ion exists, which persists in the dark until the solvent is melted, when produced from a leuco-compound by illumination in a rigid solvent. W. R. A.

Crystal orientation and Raman spectrum of calcite. K. Venkateswarlu (*Current Sci.*, 1942, **11**, 100; cf. Bhagavantam, A., 1940, I, 195).—Intensity data for the 1085 cm.$^{-1}$ Raman line from a 1-in. calcite tube, observed in two directions, show that the tensor components are related by $a_{xx} = a_{yy} = 2{\cdot}8a_{zz}$. A. J. E. W.

Raman spectra of iodic acid at different dilutions. J. R. Saraf (*Current Sci.*, 1942, **11**, 101).—Raman data (with intensities) are given for 0·03—4·5N-HIO_3 and 0·2N-KIO_3. Changes on dilution conform to other observations suggesting progressive depolymerisation of $(HIO_3)_3$ (cf. Nayar *et al.*, A., 1939, I, 198; 1941, I, 294). A. J. E. W.

Raman spectra of crystals excited by mercury resonance radiations. R. Kishore (*Proc. Indian Acad. Sci.*, 1942, **16**, **A**, 36—44).—Raman spectra, excited by Hg 2537 A., are reported for small crystals of quartz, alumina, barytes, celestite, witherite, and gypsum. W. R. A.

Effect of temperature on the intensities of Raman lines. II. Crystals. K. Venkateswarlu (*Proc. Indian Acad. Sci.*, 1942, **16**, **A**, 45—49; A., 1942, I, 227).—The effect of temp. on the intensities of the Raman lines of calcite is investigated. Increased temp. leads to diminished intensity, particularly with lattice lines. Placzek's theory of the dependence of the intensities of the vibrational Raman lines on temp. does not agree with observational data, particularly for lines of low ν. With rise of temp. the lattice lines are displaced towards the exciting line but the other lines are unaltered. W. R. A.

Raman spectrum of 1 : 3 : 5-triphenylbenzene. S. K. Mukherji and L. Singh (*Nature*, 1942, **150**, 347).—The Raman spectrum of 1 : 3 : 5-$C_6H_3Ph_3$ in CS_2 or CCl_4 closely resembles that of *m*-$C_6H_4Ph_2$, but the very strong line at 1309 cm.$^{-1}$ in the latter is absent, and the stronger frequency of the doublet at 1597 cm.$^{-1}$ is not observed. A. A. E.

Raman effect and problems of constitution. XVIII. Hexachlorobutadiene and octachloro*cyclo*pentene. K. W. F. Kohlrausch and H. Wittek (*Ber.*, 1942, **75**, [*B*], 227—232).—The observation of 5 certainly and 4 probably polarised and of 3 certainly and 3 probably depolarised in addition to 4 lines of undetermined degree of polarisation (in all 19 lines) is not compatible with the *trans* form with symmetry C_{2h} for hexachlorobutadiene, which requires 9 polarised and 3 depolarised (total 12) lines. A non-planar form (C_2) is indicated which requires 13 polarised and 11 depolarised lines. For the compound C_5Cl_8 25 lines are observed, of which 8 are certainly and 2 probably polarised and 10 certainly and 4 probably depolarised; there is no contradiction to the symmetry C_2 and 33 lines (11 polarised and 22 depolarised) which are required for octachloro*cyclo*pentene. In both cases it is difficult to assess the extent to which the balance is disturbed by masking and the occurrence of overtones. H. W.

Dipole moment of the C–H bond. C. A. Coulson (*Trans. Faraday Soc.*, 1942, **38**, 433—444).—Approx. calculations by the mol. orbital and electron-pair methods give for the C–H bond $\mu = 0{\cdot}4$ D., the polarity being C^+H^-. μ is, with rare exceptions, nearly independent of whether the C is aliphatic, aromatic, ethylenic, or acetylenic. CH_4 is treated in detail with the use of wave functions previously determined (A., 1937, I, 223). The ionic contribution to the C–H bond is > is generally supposed. F. L. U.

Electric polarisation of mercurous trichloroacetate and of quinol bistrichloroacetate. N. R. Davidson and L. E. Sutton (*J.C.S.*, 1942, 565—567).—The apparent electric dipole moments of $(CCl_3{\cdot}CO_2)_2Hg_2$ and of *quinol bistrichloroacetate*, m.p. 136—136·5°, at 25° are 2·65±0·10 and 1·50±0·20 D., respectively, excluding rigid chelate structures and favouring the simple covalent formula for the former, with free rotation about the O–Hg–Hg–O axis. L. J. J.

Angle between the phenyl groups in αα-diphenylethylene from electric dipole moment measurements. G. E. Coates and L. E. Sutton (*J.C.S.*, 1942, 567—570).—The valency angle between the Ph groups in $CPh_2{:}CH_2$ (I) is calc. as 125°±3° from electric dipole moment measurements on (I) and on a no. of *p*-substituted derivatives. The larger val. than in CH_2Ph_2 (115±5°) or for the CH_2 angle (118°) in C_2H_4 indicates resonance involving the Ph rings and the double bond. The rings must be twisted ~30° out of the common plane to allow the min. permissible distance (2·4 A.) between unbonded H. (For new compounds see A., 1942, II, 398.) L. J. J.

Dipole moments of *cyclo*hexanol and *cyclo*hexanone in dioxan. I. F. Halverstadt and W. D. Kumler (*J. Amer. Chem. Soc.*, 1942, **64**, 1982).—The vals. for solutions in dioxan at 25° are: *cyclo*hexanol 1·82 and *cyclo*hexanone 2·90 D. W. R. A.

Dipole moments of some bile acids. W. D. Kumler and I. F. Halverstadt (*J. Amer. Chem. Soc.*, 1942, **64**, 1941—1943).—Vals. of dipole moments of bile acids in dioxan at 25° are: lithocholic 2·50, deoxycholic 3·22, hyodeoxycholic 3·12, *apo*cholic 2·98, dehydrolithocholic 3·72, cholic 3·84, 3-hydroxy-12-ketocholanic 4·26, dehydrodeoxycholic 4·82, reductodehydrocholic 5·16, dehydrocholic 5·63 D. They are not associated in dioxan at concns. < wt.-fraction = 0·017, and dielectric const.–concn. curves are linear in this range. Vals. of μ indicate the absence of choleic acids in the solutions. The dipole moment of deoxycholic acid is normal with respect to the moment of other bile acids which do not form choleic acids. W. R. A.

Dipole moment and structure of carbamide and thiocarbamide. W. D. Kumler and G. M. Fohlen (*J. Amer. Chem. Soc.*, 1942, **64**, 1944—1948).—The dipole moments of $CO(NH_2)_2$ and $CS(NH_2)_2$ in dioxan at 25° are 4·56 and 4·89 D. Plots of the dielectric const. against wt.-fractions are linear, showing that the mols. are not associated in the solution. The compounds are resonance hybrids with a 20—30% contribution from the forms with a separation of charge, and have almost the same moments as the corresponding symmetrical disubstituted compounds, all of which have two equiv. forms with a separation charge. The moments of the monosubstituted compounds, in which the two forms with a separation of charge are not equiv., are smaller, and those of the unsymmetrical disubstituted compounds smaller still. Steric hindrance probably produces the low moments of the symmetrical tetrasubstituted compounds. The existence of $CO(NH_2)_2$ and $CS(NH_2)_2$ as zwitterions is accounted for by the resonance hybrid structure, whether $CO(NH_2)_2$ is in the solid state, or in dioxan, EtOH, or H_2O solutions. The structure is essentially the same as that of the simple amides for a rather larger contribution of the forms with a separation of charge. W. R. A.

Dissociation constant, dipole moment, and structure of α-nitrotetronic acid. W. D. Kumler (*J. Amer. Chem. Soc.*, 1942, **64**, 1948—1950).—α-Nitrotetronic acid has a pK_a 1·68 and μ 6·1 D. Both the dissociation const. and μ are consistent with the presence of a strong H-bond in the enol form, which, from general stability, is more probable than the *iso*nitro-structure. W. R. A.

Effect of temperature on the validity of Hudson's rules of isorotation. W. Kauzmann (*J. Amer. Chem. Soc.*, 1942, **64**, 1626—1629).—The temp. variation of the optical rotation of carbohydrates probably accounts for discrepancies observed on the application of Hudson's rules of isorotation to the calculation of optical rotation. The rules should be more accurate at higher temp. W. R. A.

Optical rotatory dispersion of (−)-tetrahydrofurfuryl alcohol. R. S. Airs, M. P. Balfe, M. Irwin, and J. Kenyon (*J.C.S.*, 1942, 531—532).—A two-term Drude equation is derived which fits the rotatory dispersion of the alcohol recorded by Balfe *et al.* (cf. A., 1941, I, 74; II, 231). R. S. C.

Application of the method of von Fedorov's crystallo-chemical analysis to derivatives of β-resorcylaldehyde.—See A., 1942, II, 361.

Quantum-mechanical investigation of orientation of substituents in aromatic molecules.—Sec A., 1942, II, 303.

Physical constants of homologues of chaulmoogric acid and of their ethyl esters. U. T. Cardoso (*Rev. Brasil Biol.*, 1941, **1**, 75—79).—The parachor values of gorlic and oleic acids and of the Et esters of chaulmoogric, hydnocarpic, and alepric acids are very similar to those calc. according to Sugden's formula. The density, the sp. mol. refraction, and the vals. of the Eötvös–Ramsay–Shields coeff. of these compounds are determined. I. C.

Viscosity and chemical constitution. J. N. Friend (*Nature*, 1932, **150**, 432).—For unassociated liquids over a considerable temp. range, $\sigma \propto \eta^{\frac{1}{4}}$ approx. Replacing $\sigma^{\frac{1}{4}}$ by $\eta^{\frac{1}{4}}$ in Sugden's parachor, $M\eta^{\frac{1}{4}}/D$ = const. (R) (" rheochor "). R is additive and a const. fraction of the crit. vol.; it is useful in studying the constitution of liquids. A. A. E.

Volatile vegetable materials. XIX. Parachors, refractometric characteristics, and Raman effect of piperitenone and similar ketones. Y. R. Naves and G. Papazian (*Helv. Chim. Acta*, 1942, **25**, 1046—1053).—d_4^{20}, γ, $[P]$, n_F, n_D, and n_C data, and Raman frequencies of piperitenone (**I**), 1-methyl-Δ^1-*cyclo*hexen-3-one (**II**), piperitone (**III**), and pulegone (**IV**) are recorded and compared, with particular reference to the effects of conjugation of the double linkings and possibilities of resonance structures. The $[P]$ vals. for (**III**) and (**IV**) are > those calc. on the additivity law. From ϵ measurements on C_6H_6 solutions the following vals. of μ are deduced: (**I**) 2·85, (**II**) 3·30, (**III**) 3·30, and (**IV**) 3·12 D. J. W. S.

Arrangements with given number of neighbours. T. S. Chang and C. C. Ho (*Proc. Roy. Soc.*, 1942, **A**, **180**, 345—365).—The method used to find the no. of ways of arranging n B particles on N points on a straight line to produce X pairs of BB nearest neighbours is extended to find the no. of ways of arranging given nos. of A, B, C, . . . particles on N points lying in a no. of parallel planes so as to produce given nos. of various kinds of neighbours (*e.g.*, nearest, next nearest, etc.) formed by different pairs of particles. The case of particles on two rows is examined in detail. G. D. P.

III.—CRYSTAL STRUCTURE.

Reflexion of *X*-rays with change of frequency. (Sir) C. V. Raman (*Nature*, 1942, **150**, 366—369).—A review of investigations, showing how the reality of the changes has been demonstrated and their magnitude determined from intensity measurements at various temp. A. A. E.

New synthesis of *X*-ray data for crystal analysis. S. H. Yü (*Nature*, 1942, **149**, 638—639).—Mathematical. A more efficient method of using Patterson vector diagrams in crystal analysis is developed. Compared with the classical Patterson method, it enables more useful information to be derived from the observational data, and narrows down the choice of alternative structures in an analysis. W. J.

Modified Patterson function. C. S. Lu (*Nature*, 1942, **150**, 407).—Although a new interpretation of the Patterson function or related functions is desirable in analysis of crystal structure, the method suggested by Yü (preceding abstract) does not appear, for reasons given, to offer a better solution than Patterson's original function. W. J.

Effect of thermal vibrations on the scattering of *X*-rays. II. (Miss) K. Sarginson (*Proc. Roy. Soc.*, 1942, **A, 180**, 305—320; cf. A., 1942, I, 135).—The theory previously developed is extended. Only the acoustical branches of the elastic spectrum can produce extra spots. Formulæ for the position and shape of extra spots in the vicinity of Laue spots are given for cubic crystals. G. D. P.

Temperature variation of diffuse scattering of *X*-rays by crystals. M. Born and K. Lonsdale (*Nature*, 1942, **150**, 490).—The theoretical scattering power for single crystals near, or not too far above, the Debye temp. is recalc. (cf. Sarginson, *supra*) and compared with quant. measurements by Laval for KCl at 290° K., 550±10° K., and 665±15° K. The predictions of the thermal theory are confirmed, the agreement being well within the claimed 10% limits of experimental accuracy. It is legitimate to assume constancy of intensity distribution with change of temp. W. J.

Temperature diffuse diffraction maxima and crystal perfection. D. S. Teague (*Physical Rev.*, 1942, [ii], **62**, 179).—Variation of the angle of deviation of Mo *Kα* with angle of incidence for Fe, Zn blende, barite, calcite, Rochelle salt, and quartz (in order of increasing structural perfection) shows only rough qual. agreement with calc. vals. N. M. B.

Model illustrating intercrystalline boundaries and plastic flow in metals. (Sir) W. L. Bragg (*J. Sci. Instr.*, 1942, **19**, 148—150).—A two-dimensional model of a metallic lattice is formed by a raft of small equal bubbles, produced by an orifice under the surface of a soap solution. Adjacent " crystals " in such a lattice show no intercryst. " Beilby amorphous layer," but merely slight dislocation at the boundaries. Stress–strain curves for the model show slip phenomena corresponding with those in metallic lattices. L. J. J.

Machine for rapid summation of Fourier series. D. Macewan and C. A. Beevers (*J. Sci. Instr.*, 1942, **19**, 150—156).—The machine described, built from standard telephone and radio accessories, performs automatically the Fourier synthesis process by Beevers' and Lipson's *X*-ray crystallographic methods. L. J. J.

Improved *X*-ray tube for diffraction analyses.—See A., 1942, I, 377.

Interatomic distances in carbon. A. Taylor (*Nature*, 1942, **150**, 462—463).—The available data for carbons are reviewed in the light of Warren's (A., 1941, I, 325) mathematical treatment of diffraction of *X*-rays from random layer-lattices. The results lead to an almost const. val. of the C—C distance, namely 1·415 A., the val. in macrocryst. graphite, and directly confirm Warren's equations. The new cross-lattice dimension equation conforms to the association of the grain-growth of C with plate-like crystallites. W. J.

Symmetry and physico-chemical properties of crystalline compounds. I. Distribution of crystal structures over the 219 space-groups. W. Nowacki (*Helv. Chim. Acta*, 1942, **25**, 863—878).—A statistical analysis. J. W. S.

Diffuse scattering of copper *Kα* *X*-rays from single zinc crystals. O. J. Baltzer and E. M. McNatt (*Physical Rev.*, 1939, [ii], **55**, 237). A. J. E. W.

Imperfections in the structure of cobalt. I. Experimental work and proposed structure. (Miss) O. S. Edwards and H. Lipson. **II. Mathematical treatment of proposed structure.** A. J. C. Wilson (*Proc. Roy. Soc.*, 1942, **A, 180**, 268—277, 277—285).—I *X*-Ray powder photographs of hexagonal Co have a mixture of sharp and diffuse lines. This is the result of the presence of a series of faults in the crystal. These faults occur on the basal plane of the crystal and are due to the fact that there are different ways in which neighbouring layers of atoms can be packed.

II. The close-packed structures are made by piling planes of atoms in three different relative positions, *A*, *B*, *C*. In hexagonal close packing only two of these are used, *i.e.*, *ABAB* . . . or *BCBC* . . . or *CACA*. . . The intensity of reflexion is calc. for a structure in which regions of *ABAB* are interleaved with regions of *BCBC* or *CACA*. Agreement with experiment is obtained if faults occur on the average once in ten planes. G. D. P.

Simple explanation of austenitic iron. A. Chongoli (*Rev. Brasil. Quim.*, 1942, **13**, 256).—Description of the structure and properties of Fe and its alloys. F. R. G.

Structure of LiPb. H. Nowotny (*Z. Metallk.*, 1941, **33**, 388).—LiPb has a *β*-brass structure, *a* 3·522 A., Li atoms at 000 and Pb at ½½½, distance Li—Pb 3·05 A. No disorder occurs below 260°. LiPb does not conform to the valency electron concn. rule. A. R. P.

Crystal system and unit cell of acanthite, Ag_2S.—See A., 1942, I, 380.

Crystal structure of the thorium silicide, $ThSi_2$. G. Brauer and A. Mitius (*Z. anorg. Chem.*, 1942, **249**, 325—339).—$ThSi_2$ is face-centred tetragonal with *a* 4·126, *c* 14·346 A., space-group D_{4h}^{19}, 4 mols. in the unit cell, *ρ* 7·63. At. positions and interat. distances are given. F. J. G.

Disilicides of niobium, tantalum, vanadium, and rhenium. H. J. Wallbaum (*Z. Metallk.*, 1941, **33**, 378—381).—VSi_2, $TaSi_2$, and $NbSi_2$ have a *C*-40 type of lattice like $CrSi_2$; $ReSi_2$ has a *C*-11 type lattice like $MoSi_2$. The lattice consts. are: VSi_2 *a* 4·562 A., *c*/*a* 1·359; $TaSi_2$ *a* 4·773 A., *c*/*a* 1·373; $NbSi_2$ *a* 4·785 A., *c*/*a* 1·374; $ReSi_2$ *a* 3·123 A., *c*/*a* 2·452. Details of the structures are given and discussed. A. R. P.

Superstructure of Cu_3Sb. W. Hofmann (*Z. Metallk.*, 1941, **33**, 373).—Cu_3Sb has a face-centred cubic lattice, *a* 6·00 A., the unit cell having a substitution superlattice of the Cu_2AlMn type; the phase is stable only above 432° and has a wide range of homogeneity towards both the Sb and the Cu sides. A. R. P.

Crystal structure of calcium cyanamide. M. A. Bredig (*J. Amer. Chem. Soc.*, 1942, **64**, 1730—1731).—$CaCN_2$ has a structure completely analogous to NaN_3 and *c* 14·85, *a* 3·67 A., *ρ* 2·29, $Ca^{"}$ ions occupy 000, C atoms ½½½, and N atoms ± (*uuu*); C—N = 1·16± 0·08, Ca—N = 2·49±0·04 A. W. R. A.

Formation of a double crystal aggregate and the structure of the intermediate temperature modification of $Ni(NO_3)_2,6NH_3$. S. H. Yü (*Nature*, 1942, **150**, 347—349).—Although the external shape of the crystal is unchanged, the crystallites must have their crystal axes confined to the two mutually perpendicular axes of the original single crystal. The symmetry shown by the photographs is not the actual symmetry of the structure. A similar consideration may affect other determinations of the space-group of a structure. The cryst. grains in some polycryst. metals may be composed of such aggregates. A. A. E.

Folding of the selenanthren molecule. R. G. Wood and G. Williams (*Nature*, 1942, **150**, 321—322).—A projection made by Fourier synthesis suggests that the angle of fold about the line forming the Se atoms is 127°, the C—Se distance is 1·96 A., and the valency angle of Se is 96°. A. A. E.

Crystal-chemical studies of the alums. IV. Coefficients of linear thermal expansion. H. P. Klug and L. Alexander (*J. Amer. Chem. Soc.*, 1942, **64**, 1819—1820).—Linear thermal expansion coeffs. for several alums for the approx. range 20—50°, measured by means of *X*-ray diffraction, are: $KAl(SO_4)_2$, 11·0±0·3; $NH_4Al(SO_4)_2$, 9·5±0·2; $TlAl(SO_4)_2$, 13·1±0·3; and $NH_4Cr(SO_4)_2$, 10·6±0·4 × 10^6 (H_2O of crystallisation omitted from formulæ). W. R. A.

Structures of methylene*cyclo*butane and hexamethylethane. S. H. Bauer and J. Y. Beach (*J. Amer. Chem. Soc.*, 1942, **64**, 1142—1147).—From electron diffraction data the C atoms of methylene*cyclo*butane are coplanar, 4 at the corners of a square (1·56±0·03 A. side) and the fifth on the extension of one of the diagonals (1·34± 0·02 A.) from the C atom in the ring). The data for C_2Me_6 favour the staggered model but do not completely exclude other mol. models (eclipsed, free rotation). The central C—C is 1·58±0·03; other C—C, 1·54±0·02 A.; C valency angles 111 + 2°. W. R. A.

Crystal structure of oxyhæmoglobin.—See A., 1942, III, 873.

Structure of *o*-dinitrosobenzenes.—See A., 1942, II, 380.

***X*-Ray diffraction measurements on biotin.** I. Fankuchen (*J. Amer. Chem. Soc.*, 1942, **64**, 1742—1743).—Under the polarising microscope the long thin needles of biotin show straight extinction, and have a rhombus cross-section with acute angle 55°. The crystal is optically negative. These data suggest an orthorhombic crystal, and this has been confirmed by *X*-ray investigations, which show that the space-group is $P2_12_12_1$ and has four general positions, 4 mols. per unit cell, *ρ* 1·41, mol. wt. 245±6, *a* 5·25, *b* 10·35, *c* 21 A. W. R. A.

Supermolecular structure of cellulose. O. Kratky (*Kolloid-Z.*, 1942, **98**, 170—172).—*X*-Ray investigation shows that the alkali-cellulose micelles present in regenerated cellulose from the xanthate process are completely decomposed or greatly distorted on subsequent dissolution in NaOH. Studies of the deformation of cellulose hydrate threads indicate that the micelles are leaf-like, and that

there is a uniform distortion of the space surrounding the micelles. Small-angle scattering forms a suitable basis for the statistical determination of micelle sizes. If a liquid with the same electron density as cellulose is inserted into the intermicellar spaces, the small-angle scattering disappears, and this provides a method for the determination of electron density. A. J. M.

Electron microscopy and the structure of cellulose fibres. W. Wergin (*Kolloid-Z.*, 1942, **98**, 131—141).—Results of the investigation of cellulose fibres by means of the electron microscope are summarised. The electron microscope confirms the presence of a fibril structure, which has also been observed with the optical microscope. There is also a further division of fibrils into parallel threads of diameter 300—500 A., though a few are smaller (100 A.) and a few larger (750 A.) than this. These are the smallest structural units of the fibre, and may be called micelle threads. The fibril bundles are surrounded by a surface sheath, which makes the bundle into an individual unit. A. J. M.

Investigation of the molecular structure of nitromethane, methyl nitrite, and methyl nitrate in the vapour phase by electron diffraction. F. Rogowski (*Ber.*, 1942, **75**, [*B*], 244—269).—Nitromethane probably has a plane CNO skeleton with the distances C—N = 1·47±0·02 and N—O 1·22±0·02 A. in each case with an angle ONO between 130° and 140°. A non-planar arrangement as in NH_3 or the presence of an oximino-component with nuclear distances >5% outside the indicated experimental error is excluded. Me nitrite has a plane mol. twice bent with the tetrahedron angle and the distances C—O = 1·44±0·02, O—N = 1·37±0·02, and N—O′ = 1·22±0·02 A. In the vapour phase Me nitrate has a mol. bent twice in the same direction and having the central O and N at the points of flexion. N is at the top of an irregular pyramid with O at the three corners. The individual distances are C—O = 1·44±0·03, O—N = 1·37±0·04. N—O′ = 1·22±0·04 A. in each case. The angles CON and ONO′ are tetrahedron angles and the angle O′NO′ is 131°±5°. H. W.

Electron diffraction investigation of propargyl chloride, bromide, and iodide. L. Pauling, W. Gordy, and J. H. Saylor (*J. Amer. Chem. Soc.*, 1942, **64**, 1753—1756).—Investigation of electron diffraction of the propargyl halides yields interat. distances: C≡C 1·20 (assumed), C—C 1·47±0·02, C—Cl 1·82±0·02, C—Br 1·95±0·02, and C—I 2·13±0·03 A., and the angles C–C–Cl 111±2°, C–C–Br 112±2°, and C–C–I 111±3°. W. R. A.

Habit and orientation in electron diffraction. R. P. Johnson and W. R. Grams (*Physical Rev.*, 1942, [ii], **62**, 77—79).—Electron diffraction patterns of etched W surfaces apparently indicate a preferred orientation of the crystallites, with [100] perpendicular to the surface. Actually, the etching leaves, on grains of a certain orientation, a structure very favourable for diffraction, and these selected grains dominate in the scattering. Analogous results appear in studies of clays and of graphite. It is suggested that crystal habit may often replace preferred crystal orientation as the cause of arcing in reflexion patterns. N. M. B.

Electron-microscope observations on zinc black.—See A., 1942, I, 361.

Induced colour in crystals by deuteron bombardment. J. M. Cork (*Physical Rev.*, 1942, [ii], **62**, 80—81).—The nature and characteristics of changes due to bombardment by 10-Me.v. deuterons in the cyclotron are given for NaF, NaCl, NaI, KCl, KBr, KI, fluorite, quartz, beryl, and diamond. N. M. B.

Disperse structure of solid systems and its thermodynamic basis. IX. D. Balarev [with E. Alexeev] (*Kolloid-Z.*, 1942, **99**, 291—293).—Data for the temp. of the beginning of grey glow of Au and Ag afford additional evidence for the author's view that the disperse structure of solid systems has a thermodynamic basis, since they can only be explained on the assumption that each temp. corresponds with a definite conglomerate in which the metal particles and their environment form a thermodynamically stable system. C. R. H.

Disperse structure of solid crystal systems. D. Balarev (*Kolloid-Beih.*, 1940, **51**, 123—140).—The author's theory leads to the conclusion that the differences between typical colloidal systems and ordinary crystals are non-essential and purely quant. Several corollaries of this proposition are specified and discussed. F. L. U.

Theory of finite deformations of elastic crystals. R. Fürth (*Proc. Roy. Soc.*, 1942, **A, 180**, 285—304).—The theory of finite deformation of cubic crystals at zero temp. is developed to a second-order approximation. A no. of special cases are worked out in detail. The observed deviations from Hooke's law are in agreement with the theory, and other second-order effects are predicted. Methods of determining the interat. force law are indicated. G. D. P.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Dissociation of hexa-arylethanes. XIII. Halogen substituents.—See A., 1942, II, 399.

Tin tri-*o*-tolyl and the instability of organo-metallic free radicals.—See A., 1942, II, 431.

Magnetic study of phototropic compounds. Magnetic susceptibilities of *p*-dimethylamino- and *p*-diethylamino-anilocampbor. M. Singh and T. R. Datt (*J. Indian Chem. Soc.*, 1942, **19**, 130—134).—The magnetic susceptibilities of these compounds change in light, the change being accompanied by a darkening in colour. The results can be explained by free-radical formation. J. W. S.

Propagation of sound in liquids and viscosity. G. Suryan (*Indian J. Physics*, 1942, **16**, 77—81).—An empirical relation between sound velocity (v) and η of liquids is given. The propagation of sound in liquids is discussed on the basis of energy transference between mols. $v \propto 1/\sigma^9$, where σ is mol. diameter. W. R. A.

Emissivities and temperature scales of the iron group. H. B. Wahlin and R. Wright (*J. Appl. Physics*, **13**, 40—42).—The emissivities for λ 0·667 μ. of pure Fe, Ni, and Co after complete degassing, at 1100—1500°, are determined by the disappearing-filament method. They are nearly const. at 0·41, 0·34—0·35, and 0·37—0·38, respectively, except for a sudden change to 0·44—0·45 at the Fe A3 point. L. J. J.

Magnetism and the third law of thermodynamics. Heat capacity of manganous fluoride from 13° to 320° K. J. W. Stout and H. E. Adams (*J. Amer. Chem. Soc.*, 1942, **64**, 1535—1538).—The C_p/T curve of MnF_2 in the range 13—320° K. shows a max. at 66·5° K. on account of the changing distribution of magnetic $Mn^{..}$ ions among available energy states. From C_p data the entropy of MnF_2 at 298·16° K. is 22·25 g.-cal. per degree per mol. W. R. A.

B.p. of *n*-alkyl acids. W. O. Pool and A. W. Ralston (*Ind. Eng. Chem.*, 1942, **34**, 1104—1105; cf. A., 1940, I, 388).—B.p. at various pressures are recorded for *n*-alkyl acids of 6 to 18 C atoms. A. T. P.

High-temperature heat content of Mn_3O_4, $MnSiO_3$, and Mn_3C. J. C. Southard and G. E. Moore (*J. Amer. Chem. Soc.*, 1942, **64**, 1769—1770).—Heat contents of Mn_3O_4, $MnSiO_3$, and Mn_3C have been determined from room temp. to temp. between 1140° and 1500°. Transitions of Mn_3O_4 at 1172° and Mn_3C at 1037° are reported. The increments of the heat contents and entropies of these substances above room temp. at 100° intervals have been tabulated from these and previous available data. (Cf. A., 1942, I, 398.) W. R. A.

Thermal expansion of aluminium. A. J. C. Wilson (*Proc. Physical Soc.*, 1942, **54**, 487—491; cf. A., 1941, I, 200).—The double curvature previously found is characteristic of unannealed filings, and disappears after the filings have been heated above 600°. Data for the expansion coeff. of annealed filings are given, and observations on the effect of cold-work are reported. N. M. B.

Pyknometric precision method for liquids and solids. IV. Redetermination of the density of pure potassium chloride, potassium bromide, and sodium bromide at 0°. T. Batuecas and J. J. Cernander-Alonso (*Z. physikal. Chem.*, 1942, **A, 190**, 272—277; cf. A., 1936, 417; 1938, I, 130).—With the technique described previously and PhMe as pyknometric liquid, the following vals. of d_4^0 have been obtained; KCl 1·9917±0·0003, KBr 2·7548±0·0004, and NaBr 3·2109±0·0005 g. per ml. From these data the lattice consts. are 3·144, 3·298, and 2·986 × 10^{-8} cm., respectively. After drying with $CaCl_2$, PhMe contains active Cl which cannot be removed by distillation. J. W. S.

Statistical mechanics of change of state. H. Snyder (*Physical Rev.*, 1942, [ii], **62**, 63—67).—Mathematical. N. M. B.

Compressibility of liquid *n*-octane. W. A. Felsing and G. M. Watson (*J. Amer. Chem. Soc.*, 1942, **64**, 1822—1823).—The compressibility of liquid n-C_8H_{18} has been determined from 100° to 275° at 25° intervals, and at pressures from the v.p. to ~300 atm. The sp. vol. is related to the pressure at different temp. W. R. A.

Viscosity of *cis*- and *trans*-decahydronaphthalene. W. F. Seyer and J. D. Leslie (*J. Amer. Chem. Soc.*, 1942, **64**, 1912—1916).—η of *cis*- and *trans*-decahydronaphthalene have been measured from −30° to 180°. Straight lines are not obtained when log η is plotted against $1/T$, and there is evidence that the *cis*-form undergoes some change at 110°. An explanation is advanced of the high vals. of η and $E_{vis.}$, the average molar activation energy, and the effect of *cis–trans* isomerism on them. W. R. A.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Change of sign of thermal diffusion factor. K. E. Grew (*Nature*, 1942, **150**, 320).—Change of sign of the thermal diffusion factor with composition (Chapman, A., 1940, I, 436; 1941, I, 201) occurs in Ne–NH_3 mixtures. For 0—75% Ne the Ne mols. diffuse up the temp. gradient; for >75% Ne they concentrate at the lower end. A. A. E.

Interpretation of the slope of experimental double refraction curves. H. H. Pfeiffer (*Kolloid-Z.*, 1942, **99**, 259—262).—Frey-Wyssling's explanation (A., 1940, I, 358) of the form of double refraction curves, which is based on the different polar characteristics of cell substance and imbibed liquid, is applied to data of W. J. Schmidt for Thoulet's solution imbibed by the rods of the retina of *Rana temporaria*. C. R. H.

Do all binary systems show an approximation to Raoult's law with increasing dilution? K. Fredenhagen and E. Tramitz (*Kolloid-Z.*, 1942, **99**, 283—290).—Available data lead to the conclusion that all binary systems approximate to Raoult's law with increasing dilution. Errors in an earlier paper (cf. A., 1942, I, 365) are corr. C. R. H.

Interpretation and calculation of osmotic pressure. K. Fredenhagen (*Kolloid-Z.*, 1942, **99**, 277—283).—A theory of osmotic pressure differences which demonstrates their identity with the thermal pressure of solutes is presented. C. R. H.

Wave theory of osmotic pressure. R. Lucas (*Compt. rend.*, 1942, **214**, 25—27).—Thermal agitation theory gives $\Pi = \{1 + 1{\cdot}5(c/D)(\mathrm{d}D/\mathrm{d}c)\}cRT/M$ (D = diffusion const., M = mol. wt. of solute). The semipermeable membrane is regarded as transparent to thermal agitation waves of solvent mols., those of solute mols. being reflected. A. J. E. W.

Physical effects of progressively diluted substances. E. Heintz (*Naturwiss.*, 1941, **29**, 713—725).—Solutions of $NaNO_3$, Na salicylate, $Pb(NO_3)_2$, $Cu(NO_3)_2$, AcOH, N_2H_4, and $CaCO_3$ were successively diluted 10 times, and the infra-red and ultra-violet absorption and electrical conductivity were determined at each stage. If the original solution is designated as D_1, the solution obtained by diluting it 10-fold is D_2, 100-fold D_3, etc. The infra-red absorption spectrum becomes progressively weaker with dilution, but does not disappear with D_4, D_5, or D_6, as would be expected, but varies rhythmically with dilution down to D_{30}, the position of the absorption being approx. the same as that of the original solution. The max. in the absorption occur at D_4, D_6, D_9, D_{11-12}, D_{14}, D_{17-19}, D_{21}, D_{23}, and D_{28}, and the periodicity is independent of the nature of the solute or solvent. The effect is observed only if the dilution is carried out successively, and depends entirely on the no. of dilutions. If a highly diluted solution is boiled, subsequent dilution does not bring about this effect. No periodicity was observed in the ultra-violet absorption. The electrical conductivity, however, shows the same periodicity as the infra-red absorption, provided EtOH, not H_2O, is used as the solvent, and all vessels are from the same glass batch. A. J. M.

Apparent molal volumes of aqueous solutions of sulphuric acid at 25°. I. M. Klotz and C. F. Eckert (*J. Amer. Chem. Soc.*, 1942, **64**, 1878—1880).—ρ of aq. H_2SO_4 (0—3M.) have been measured and the apparent molal vols. interpreted in terms of the vols. of H^+, SO_4'', and HSO_4' ions. The apparent molal vols. of H^+ and HSO_4' ions have been calc. by a series of successive approximations. W. R. A.

Plumbic acetate–anhydrous acetic acid solutions. A. W. Davidson, W. C. Lanning, and (Miss) M. M. Zeller (*J. Amer. Chem. Soc.*, 1942, **64**, 1523—1527).—$Pb(OAc)_4$ behaves in AcOH as a non-electrolyte, whereas $Pb(OAc)_3$ behaves as a weak electrolyte. The solubility of $Pb(OAc)_4$ in AcOH from 16° to 94° is ~1/40 that of $Pb(OAc)_2$; no solvate was isolated. The solubility of $Pb(OAc)_4$ in AcOH containing NaOAc decreases as [NaOAc] is increased owing to salting out; no evidence of amphoteric behaviour has been found. W. R. A.

Dielectric investigation of polypeptides. II. Dispersion of simple amino-acid polypeptides. W. P. Conner and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 1870—1878).—The dielectric consts. (ϵ) of liquids at $\lambda\lambda$ from 40 to 80 cm. have been measured by the first Drude method with an apparatus which is described. η and ϵ of aq. solutions of ten NH_2-acid peptides in this region of anomalous dispersion have been measured. The mechanism of dispersion has been discussed and the results have been combined with previous ϵ measurements at 10 m. to calculate the relaxation times and shape factors for the solute mols. Although the results are not inexplicable in terms of internal rotation around valency bonds in the mols., the vals. and their trend are consistent with the simple picture of rotation of the mol. as a whole. W. R. A.

Symbols for heterogeneous equilibria (metallographic shorthand). H. Hanemann (*Z. Metallk.*, 1941, **33**, 374—375).—Shorthand characters for various terms used in metallography, *e.g.*, eutectic, peritectic, eutectoid, are proposed and their uses illustrated. A. R. P.

Equilibrium diagram of alloys at low temperatures. G. Masing (*Naturwiss.*, 1942, **30**, 157—161).—It is pointed out that whilst at high temp. it is possible to ascertain the true equilibria in alloy systems if sufficient time is allowed for the stable state to be reached this is almost impossible at lower temp. since, owing to the slow rate of diffusion and the slow formation of nuclei, very prolonged maintenance at a given temp. is necessary to ensure that the equilibria have been established. Hence the published diagrams for systems at temp. well below the solidus represent only the limiting positions of the phase fields attainable in a reasonable time. The subject is discussed from the thermodynamic viewpoint with reference to the Fe–Mo, Fe–C, and Au–Ni systems. A. R. P.

Ternary valency compounds in (copper, silver)–(arsenic, antimony, bismuth)–magnesium systems. H. Nowotny and W. Sibert (*Z. Metallk.*, 1941, **33**, 391—394).—Compounds of the type $A{\cdot}B{:}C$ occur in all these ternary systems, except Ag–Bi–Mg. CuSbMg, CuBiMg, and AgAsMg have a CaF_2 structure with a 6·152, 6·256, and 6·240 A., respectively. CuAsMg has a tetragonal C-38 type lattice, a 6·393 A., c/a 1·576, 6 atoms per unit cell, and AgSbMg has a somewhat similar lattice of lower symmetry. Data on the distribution of the atoms in the lattices are included and the relations between their structures and those of CaF_2 and Mg_3As_2 are discussed. A. R. P.

Precipitation mechanism in crystals of aluminium–silver alloys during structural hardening. A. Guinier (*Compt. rend.*, 1942, **214**, 34—37).—The mechanism is studied by a special X-ray examination (cf. B., 1940, 534) of a single-crystal (Al 80, Ag 20%) quenched from 540° and reheated at 100—250°. The changes which occur are (*a*) a progressive concn. of Ag atoms in small nuclei distributed at approx. regular intervals through the lattice, and (*b*) transformation of the cubic lattice in these nuclei to the hexagonal lattice of the γ-phase (~Ag_2Al) by slipping of (111) planes. A. J. E. W.

Recrystallisation diagram of manganese–magnesium and cerium–manganese–magnesium alloys. H. Y. Jan and W. Hofmann (*Z. Metallk.*, 1941, **33**, 361—369).—Diagrams are constructed showing the effects of annealing temp. and % reduction on the hardness and grain size of Al with (*A*) Mn 2%, and (*B*) Mn 2, Ce 0·5%. There is a wide temp. range between the beginning and ending of recrystallisation of cold-rolled *A* but only a small range with the hot-rolled alloy. Between 350° and 450° the grain size of hot-worked *A* is a max. after 60% and a min. after 20% reduction; very coarse grain size is obtained on annealing either the hot- or cold-worked alloy at 550°. Alloy *B* has a much smaller grain size than *A* after all heat- and mechanical treatments and a much higher recrystallisation temp. and smaller range between the beginning and ending of recrystallisation; there is no coarse grain growth at 550°, and the hot-worked alloy does not develop a granular structure as does *A*. A. R. P.

System magnesium–copper–antimony. E. Scheil and W. Sibert (*Z. Metallk.*, 1941, **33**, 389—391).—The ternary compound MgCuSb (**I**), m.p. 930°, forms quasibinary systems with Cu, Sb, Mg_3Sb_2, Cu_2Sb, and the ϵ-Cu-Sb phase, and Mg_3Sb similar systems with Mg_2Cu, $MgCu_2$, and Cu. Binary eutectics occur at 555°, ~4% Sb, between Mg_3Sb_2 and Mg_2Cu; at 720°, 10% Sb, between Mg_3Sb_2 and $MgCu_2$; at 720°, 20% Sb, between Cu and Mg_3Sb_2; at 730°, 23% Sb, between Cu and (**I**); at 540°, ~43% Sb, between (**I**) and ϵ-Cu–Sb; and at an undetermined temp. and composition near Mg_3Sb_2 between that compound and (**I**). Ternary eutectics occur at 470°, Cu 22, Sb 13% between Mg, Mg_3Sb_2, and Mg_2Cu; at 540°, Mg ~36, Sb ~3% between Mg_3Sb_2, $MgCu_2$, and Mg_2Cu; at 680°, Cu 75, Sb 13% between Cu, Mg_3Sb_2, and $MgCu_2$; at 555° Cu 3, Mg 4% between Sb, (**I**) and Mg_3Sb_2; and at 510°, Mg~2, Cu~23% between Sb, Cu_2Sb and (**I**). Three-phase reactions probably of the peritectic type occur at 540° in the Cu_2Sb–(**I**) system and at 565° in the Sb–(**I**) system. Pptn.-hardening can be produced in Cu containing Mg ~0·25, Sb~1%. A. R. P.

δ_1 and ζ phases in iron- and cobalt–zinc systems. F. Götzl, F. Halla, and J. Schramm (*Z. Metallk.*, 1941, **33**, 375).—Single crystals of ζ-Fe–Zn with 6·3% Fe had a 13·65, b 7·61, c 5·10 A., β 128° 44′; similar crystals of ζ-Co–Zn with 6·9% Co had a 13·46, b 7·49, c 5·06 A., β 127° 5′. The δ_1 Fe–Zn phase has a 12·80 A. (7% Fe) and a 12·81 A. (8·5% Fe). A. R. P.

Dilatometric study of solid solubility of silicon in aluminium. H. Borchers and H. J. Otto (*Aluminium*, 1942, **24**, 219—221; *Bull. Brit. Non-Ferrous Met. Res. Assoc.*, 1942, 310).—Al containing up to 1·41% of Si was studied by the thermal expansion method The solubility data showed good agreement with those obtained by Durer (*Z. Metallk.*, 1940, **32**, 280) using thermoelectric measurement. Conclusions on pptn., balling-up, and solution phenomena are drawn. R. B. C.

Quaternary system aluminium–bismuth–lead–antimony. G. W. Kasten (*Wiss. Veröff. Siemens-Werken, Sonderh.*, 1940, 50—65; *Bull. Brit. Non-Ferrous Met. Res. Assoc.*, 1942, 325).—The equilibrium diagram is worked out and discussed. All the binary and ternary systems involved, with the exception of Al–Bi–Pb and Al–Bi–Sb, were already known. R. B. C.

Crystallographic and X-ray studies of chromium–aluminium alloys. W. Hofmann and H. Wiehr (*Z. Metallk.*, 1941, **33**, 369—372).—$AlCr_7$ crystallises in monoclinic prisms, a 20·43, b 7·62, c 25·31 A., β 155° 10′; in the 3% Cr–Al alloy it appears as flattened columns or as leaflets which are twins of the columns about the {001} plane extended in the [011] direction. Al dissolves ~0·7% of Cr at just below the m.p. but if the cast alloy is immediately quenched ~1·6% of Cr may be retained in supersaturated solid solution. A. R. P.

System cobalt-CoAl. J. Schramm (*Z. Metallk.*, 1941, **33**, 381—387).—The Al–Co system was investigated by thermal, micrographic, *X*-ray, and magnetic methods up to 25% Al. The eutectic point is 1400°, Al 10%, the α phase containing 7—9 and the β phase 10·4% Al at this temp. The solubility of Al in α-Co decreases almost linearly with temp. to 1% at 300°, and the Co content of the β phase decreases along a smooth concave curve to 74% at room temp. The Curie point of Co falls linearly with increase in % Al from 720° to 840° at 4·5% Al and then remains const. to 22% Al. Slowly cooled β is non-magnetic but quenched β with >74% Co is magnetic at temp. below a line joining 18% Al at 580° with 25% Al at 20°. The β phase can be considerably, and the α phase appreciably, hardened by suitable heat-treatment. A. R. P.

Ternary system nickel-cobalt-aluminium. J. Schramm (*Z. Metallk.*, 1941, **33**, 403—412).—The equilibria from the Ni–Co side up to 25% Al, as determined by thermal, micrographic, *X*-ray, and magnetic methods, are shown in quasibinary diagrams for Ni–Co ratios of 90 : 10, 80 : 20, 50 : 50, and 20 : 80. Only four phases exist, viz.: α, cubic face-centred (Ni–Co)–Al solid solution; α', the ordered form of α; β, cubic body-centred (Ni, Co)Al; and ϵ, hexagonal Co. The reaction liquid $\rightleftharpoons \alpha + \beta$ in the Co–Al system at 1400° merges with the α + liquid $\rightleftharpoons \alpha'$ reaction at 1362° in the Ni–Al system to the four-phase equilibrium liquid + $\alpha \rightleftharpoons \alpha' + \beta$ at 1361° in the ternary system. The $\alpha + \alpha'$, $\alpha' + \beta$, and $\alpha + \alpha' + \beta$ phase fields become considerably restricted in area with rise in temp., *i.e.*, the α and β solid solution ranges are much broader at high than at low temp. so that alloys containing 5—12 or 15—25% Al can be rendered much harder and more magnetic by appropriate heat-treatment. A. R. P.

Forced directionality in precipitation from solid solution [in iron–nickel–titanium alloys]. R. Vogel (*Z. Metallk.*, 1941, **33**, 376—377).—In cast Fe–Ti–Ni alloys with Ti 10—20 and Fe <10% the primary crystallites are surrounded by a eutectic of which one component is acicular Ni_3Ti. Frequently these needles appear to penetrate into the primary crystals and this is ascribed to induced pptn. of Ni_3Ti from these crystals, the ppt. growing on the needles at their point of contact with the primary crystals. No such effect is obtained if the cast alloy is quenched and then reheated to induce pptn.; in this case the ppt. grows in clusters from nuclei in the centre of the crystals and its orientation is controlled by the lattice forces. These forces are weak in the first case so that the hard Ni_3Ti needles are able to grow into the much softer primaries. A. R. P.

Solubility of propylene vapour in water as affected by typical detergents. J. W. McBain and A. M. Soldate (*J. Amer. Chem. Soc.*, 1942, **64**, 1556—1557).—An extension of previous work (A., 1941, I, 259) on the effect of added substances on the solubility of $CHMe{:}CH_2$ in H_2O shows that all the detergents tested greatly increase the amount dissolved, in spite of any salting-out action which they may otherwise possess. This solubilising effect is shown by anion-active, cation-active, and non-electrolytic detergents. W. R. A.

Effect of temperature on the partition of benzoic and salicylic acid between water and benzene. A. Bekturov (*J. Gen. Chem. Russ.*, 1941, **11**, 143—145).—The partition coeffs. $[H_2O]/[C_6H_6]$ rise with increasing temp., from 25° to 60°. R. T.

Adsorption of gas from the lowest to the highest pressures. I. Mathematical analysis of equations of ideal absolute and differential adsorption. A. von Antropoff (*Kolloid-Z.*, 1942, **98**, 249—257). F. L. U.

Photo-activation of adsorption of hydrogen on thorium oxide. A. Luyckx, J. Bodart, and G. Rens (*J. Amer. Chem. Soc.*, 1942, **64**, 1731—1732).—Irradiation of the ThO_2–H_2 system (pressure of H_2 = 2 mm.) with light from a Hg lamp produces a regular and continuous decrease in pressure and complete adsorption results from 10 hr. irradiation. Further added H_2 is adsorbed on irradiation. Since adsorption is observable only with the irradiation from a cold Hg lamp it is resonance radiation that is involved and the mechanism may involve formation of at. H in the gas phase or dissociation of van der Waals adsorbed H_2 mols. by transference of energy from Hg atoms. At 20—30 mm. no photo-activation occurs. Lowering of the pressure to 2 mm. resulted in slower photoactivation than in a system initially at 2 mm. Evacuation of the system is necessary to attain comparable rates. Experiments at 700—800° are also discussed. W. R. A.

Adsorption of acids by animal charcoal. S. Caspe (*Amer. J. Pharm.*, 1942, **114**, 262—266).—Animal C (I) does not adsorb acids; the impurities present—principally phosphates—react with acids to give polybasic acids which contain untitratable H^+, *e.g.*, H_3PO_4. After shaking with (I) dil. HCl contains less H^+ when titrated with phenolphthalein indicator, but there is no reduction in the [Cl′]. Both HCl and AcOH contain the same [PO_4'''] after shaking with (I); the reduction in titratable H^+ is also the same. D. D.

Adsorption of organic compounds. I. Adsorption of ampholytes on activated charcoal. V. H. Cheldelin and R. J. Williams (*J. Amer. Chem. Soc.*, 1942, **64**, 1513—1516).—Adsorption isotherms at ~25—35° for 31 NH_2-acids, vitamins, and related substances on Darco G-60 fit the Freundlich equation and the nature of the adsorption is greatly influenced by the position of polar groups and the presence of aromatic nuclei in the mols. W. R. A.

Surface tension, co-ordination number, and the Eötvös rule. K. L. Wolf and R. Grafe (*Kolloid-Z.*, 1942, **98**, 257—262).—Temp. coeffs. of the surface tension of a no. of pure liquids have been redetermined, and the Stefan no. (ϕ) calc. For unassociated liquids ϕ lies between 3 and 4, corresponding with a co-ordination no. of 12 for the bulk liquid and 8 or 9 for the surface. The magnitude and variation with composition of ϕ for liquid mixtures is related to the packing of the mols. F. L. U.

Reproducible contact angles on reproducible metal surfaces. II. Interfacial contact angles between water and organic liquids on surfaces of silver and gold. III. Contact angles of saturated aqueous solutions of different organic liquids on silver and gold. F. E. Bartell and P. H. Cardwell (*J. Amer. Chem. Soc.*, 1942, **64**, 1530—1534, 1641—1643).—II. Interfacial contact angles for H_2O drops on Ag and Au and for drops of *iso*-C_5H_{11}·OH, Bu^{n}OAc, C_6H_6, C_7H_{16}, and 1-$C_{10}H_7Br$ on Ag and Au immersed in H_2O were measured with the sessile drop apparatus (A., 1942, I, 236). For each system a stable advancing and stable receding angle was found. The vals. of these angles for H_2O are equal to those obtained for org. liquid drops on the solids in H_2O. Stable advancing angles for all org. liquids are 128° for Ag and 117° for Au. Stable receding angles for C_6H_6 and C_7H_{14} are 57·5° for Ag and 45° for Au. For the other liquids the val. of the stable receding angle is the greater the greater is the solubility of the liquid in H_2O. The existence of two different stable interfacial contact angles is due to solid surfaces contiguous to fluid phases becoming altered by adsorption from the fluids or by formation of condensed layers of fluid.

III. Measurements of the contact angles of drops of saturated aq. solutions of the org. liquids in Part II indicate that the metal surfaces adsorb air and org. liquid from air and from solution. A drop of solution advancing by stages across a fresh metal surface gives different vals. for contact angle at each advance because of evaporation of org. liquid into the air and resultant adsorption of vapour on the exposed metal. W. R. A.

Thermodynamic theory of electrocapillarity. D. C. Grahame and R. B. Whitney (*J. Amer. Chem. Soc.*, 1942, **64**, 1548—1552).—By assuming only equilibrium between phases the thermodynamic equations of electrocapillarity have been derived. Their interpretation is slightly different from what had been previously supposed. A general electro-capillary equation has been derived for a non-polarised electrode and its application to experimental data is discussed. W. R. A.

Surface diffusion. I. Experimental. II. Theoretical. R. C. L. Bosworth (*J. Proc. Austral. Inst.*, 1942, **9**, 134—142, 169—178).—I. Recent experimental evidence for the mobility of films adsorbed on solid surfaces, especially on Th–W filaments, is reviewed.

II. In the case of a H film on a W surface the migration of H from one W atom to another is compared with the transference of H from one C atom to another in tautomeric changes, the difference being that in the former case H may continue its migration to a third and a fourth W atom, whereas in the latter H transfers between the same two C atoms. This continued migration leads to macroscopic diffusion over the W surface. This type of diffusion is compared with physical diffusion, and the calculation of the mean free path for the former type is discussed. Solutions of Fick's diffusion equation are considered. C. R. H.

Pressure–area–temperature and energy relations of unilayers of "octadecane nitrile." L. E. Copeland and W. D. Harkins (*J. Amer. Chem. Soc.*, 1942, **64**, 1600—1603).—Unilayers of "octadecane nitrile" on H_2O have min. area of 25·8 sq. A. at 15·1° and 18 dynes per cm., giving an extrapolated area of 30 sq. A. at zero pressure. Thus the CN group gives much less condensed films than CO_2H or OH, but the hypothesis that this is due to the greater size of CN is rejected. The pressure–area curves for the intermediate phase are much steeper than for long-chain acids, showing that nitriles are less compressible, and for the expanded phase they give areas at ow pressures characteristic of the liquid-expanded state. W. R. A.

Reactions on unimolecular films: ozonisation of double linkings. II. A. Nasini and G. Mattei (*Gazzetta*, 1941, **71**, 302—311; cf. *ibid.*, 1940, **70**, 697).—A unimol. film of triolein on H_2O at const. superficial pressure, when treated with O_3 produced by a Hg-vapour lamp, increases in area. The velocity of this increase at various pressures shows that the reaction is in two phases; it is suggested that first O_2 is attached to the ester groups, and then O_3 to give an ozonide of the Harries formula, $\begin{matrix}-CH-CH-\\ \quad O\cdot O\cdot O\end{matrix}$. E. W. W.

Spreading experiments with insect viruses.—See A., 1942, III, 846.

Electrochemical properties of mineral membranes. V. Beidellite membranes and the determination of sodium. C. E. Marshall and

C. A. Krinbill (*J. Amer. Chem. Soc.*, 1942, **64**, 1814—1819).—Clay membranes have been prepared which are sensitive only to univalent cations (H-montmorillonite 490°); to uni- and bi-valent cations (H-montmorillonite 350°); and to uni-, bi-, and ter-valent cations (H-beidellite 600°). Beidellite membranes give good reproducibility for Na determinations. The potentials obtained with solutions of concn. <0·03N. were within 1 mv. of those calc. by the Nernst equation. NaCl, Na_2SO_4, and $Na_4Fe(CN)_6$ gave practically the theoretical potentials, whereas Na citrate gave low vals. attributed to complex formation. The behaviour of mixtures of cations can be predicted and the mobility ratios of the cations of some mixtures within the clay membranes have been determined. The experimental and theoretical potentials for mixtures of cations agree satisfactorily. W. R. A.

Rubber photogels.—See B., 1942, II, 414.

Rubber-like elasticity, its nature and biological significance. E. Wöhlisch (*J. pr. Chem.*, 1942, [ii], **160**, 217—241).—A discussion in which the elastic properties of rubber-like substances are contrasted with those of ordinary materials. Muscle belongs to the first-named group, and the consequences of this classification are considered. F. L. U.

Abstract and mathematical treatment of particle size degradation of cellulose. O. Eisenhut (*Kolloid-Z.*, 1942, **99**, 319).—A reply to Matthes (cf. A., 1942, I, 363). C. R. H.

Deformation and orientation of isotropic cellulose nitrate fibres. I. General, anisotropy, and *X*-ray spectrograms. II. Double refraction in the unswollen state. H. R. Kruyt, D. Vermaas, and P. H. Hermans (*Kolloid-Z.*, 1942, **99**, 244—251, 251—253).—I. In EtOH–$COMe_2$ mixtures the degree of swelling (q) of cellulose nitrate (I) increases with increase in the proportion of $COMe_2$, q increasing more rapidly when [$COMe_2$] is >20%. Extensibility also shows a max. val. at this [$COMe_2$]. Orientation increases with the degree of stretch, the increase being greater for high vals. of q. Swelling and *X*-ray data show that the deformation properties of (I) are similar to those for cellulose hydrate (II).

II. The double refraction of (I) after swelling in EtOH–$COMe_2$ mixtures and drying increases with degree of stretch and with q. The data are similar to those for (II). C. R. H.

Swelling of cellulose acetate in aqueous phenol.—See B., 1942, II, 399.

Macromolecular compounds. CCCI. H. Staudinger (*J. pr. Chem.*, 1942, [ii], **160**, 245—280).—Reply to criticisms by Ostwald (*Kolloid-Z.*, 1940, **90**, 370; 1942, **99**, 121). F. L. U.

Theory of solutions of high polymers. M. L. Huggins (*J. Amer. Chem. Soc.*, 1942, **64**, 1712—1719).—Theoretical equations derived for the activities of the components of a solution of chain mols. in a small-mol. solvent agree satisfactorily with experimental v.p., osmotic pressure, swelling pressure, and solubility measurements and only one const., μ_1, partly due to heat of mixing, must be evaluated empirically. Equations for osmotic pressure as a function of composition account for the linear relationship obtained when the ratio of osmotic pressure to concn. is plotted against concn.; for long chains the slope of the line depends on μ_1 but not on chain length. The relationships for flexible chain mols. should also apply to flexible net-work mols. For vals. of $\mu_1 >$ a crit. val. the activity–composition curve indicates separation into two phases, one almost entirely small-mol. component and the other a gel of composition depending essentially on the val. of μ_1. An equation for the solubility of a solid chain compound in a small-mol. liquid is given; it fits experimental data on the solubilities of n-$C_{34}H_{70}$ and n-$C_{60}H_{122}$ in decalin. W. R. A.

Effect of temperature and solvent type on the intrinsic viscosity of high polymer solutions. T. Alfrey, A. Bartovics, and H. Mark (*J. Amer. Chem. Soc.*, 1942, **64**, 1557—1560).—Vals. of η for a dil. solution of polystyrene or rubber depend markedly on the solvent and are high in a good solvent and low in a bad owing to changes in mean mol. shape. Vals. of η for cellulose acetate solutions are less sensitive to the nature of the solvent. Increased temp. lowers η of solutions of polystyrene or rubber in good solvents but increases η of solutions in bad solvents. Explanations are advanced and the relationship between inter- and intra-mol. agglomeration tendency is discussed. W. R. A.

Viscosity and cryoscopic data on polystyrene; Staudinger's viscosity rule. A. R. Kemp and H. Peters (*Ind. Eng. Chem.*, 1942, **34**, 1097—1102).—The cryoscopic method is unsatisfactory for polystyrenes containing >12 styrene units in the chain, as their solutions do not obey Raoult's law. A new K_{cm} val. of $0·45 \times 10^4$, ≪ that given by Staudinger (A., 1936, 295), is obtained for C_6H_6 solutions of polystyrene, for use in the equation $M = [\log(\eta/c)]K_{cm}$. A K_{cm} val. of $0·6 \times 10^4$ is also established for C_6H_6 solutions of polyindene. A. T. P.

Swelling and optical refraction of elastoidin fibres. Lecture experiment. W. J. Schmidt (*Kolloid-Z.*, 1942, **99**, 254—258).—The physical properties of elastoidin fibres are reviewed. The prep. of fibres with a sharp line of demarcation between swollen and unswollen states, suitable for demonstrating the different physical properties of the two states, is described. Part of the fibre is fixed in Canada balsam, the other extends into the liquid to be adsorbed. C. R. H.

Valency of corpuscular proteins.—See A., 1942, III, 846.

Effect of urea on protein solutions.—See A., 1942, III, 846.

Casein in mixed dispersion media. B. Jirgensons (*Kolloid-Z.*, 1942, **99**, 314—319).—The amount of $COMe_2$ and alcohols required to coagulate Na caseinate (I) sols is inversely ∝ concn. of (I). The behaviour with dioxan is more complex. In presence of 0·1N-HCl or 0·2M-$CaCl_2$ the sols are unstable in presence of 1—20% of org. solvent but become more stable as the amount of solvent is increased to 70%. This stabilising action of the solvent is independent of the character of the solvent, acid (*e.g.*, AcOH), neutral (*e.g.*, alcohols), and basic (*e.g.*, C_5H_5N) solvents being almost equally effective. C. R. H.

Precipitation processes. II. Relationship between precipitation phenomena and the fine structure of the electrokinetic double layer at silver chloride surfaces in aqueous sodium chloride solutions. B. Težak (*Z. physikal. Chem.*, 1942, **A, 190**, 257—271; cf. A., 1936, 282).—The variation of the velocity of pptn. of AgCl from aq. $AgNO_3$ with varying [NaCl] has been followed by turbidity measurements in three spectral regions and the mean particle sizes in the ppts. are deduced. At 20° the pptn. curve (graph of turbidity at a definite time t after mixing against [NaCl]) shows two pronounced max. and min., the positions of which vary with the initial [$AgNO_3$] and with t. The observations are discussed and correlated with the structures of the electrokinetic double layer. J. W. S.

VI.—KINETIC THEORY. THERMODYNAMICS.

Complex ions. III. Spectrophotometric study of complex ions in solution. R. K. Gould and W. C. Vosburgh (*J. Amer. Chem. Soc.*, 1942, **64**, 1630—1634).—The following systems of pairs of ions have been investigated by the method of continuous variations: Fe‴–CNS′; Fe″–*o*-phenanthroline; Ni″–dithio-oxalate; Cu″(Ni″)–$NH_2{\cdot}CH_2{\cdot}CO_2'$. The Cu″–$NH_2{\cdot}CH_2{\cdot}CO_2'$ system yields two compounds (1 : 1 and 1 : 2), whilst Ni″–$NH_2{\cdot}CH_2{\cdot}CO_2'$ yields a 1 : 3 compound and another (identity not established). W. R. A.

Thermodynamic study of bivalent metal halides in aqueous solution. IX. Activity coefficients of alkaline-earth metal bromides and iodides. R. A. Robinson (*Trans. Faraday Soc.*, 1942, **38**, 445—447).—Osmotic and activity coeffs. at 25°, obtained by isopiestic v.p. measurements, are recorded for $CaBr_2$, CaI_2, $SnBr_2$, SrI_2, and BaI_2. F. L. U.

High mol. wt. aliphatic amines and their salts. VII. Systems octylamine–, dodecylamine–, and octadecylamine–water. A. W. Ralston, C. W. Hoerr, and E. J. Hoffman (*J. Amer. Chem. Soc.*, 1942, **64**, 1516—1523).—The systems $C_8H_{17}{\cdot}NH_2$– (I), $C_{12}H_{25}{\cdot}NH_2$– (II), and $C_{18}H_{37}{\cdot}NH_2$– (III) H_2O have been investigated by phase rule methods and the following *hydrates* have been found: 2(I),$3H_2O$, decomp. —5·0°; (I),$6H_2O$, m.p. 35·6°; 3(II),$2H_2O$, decomp. 24·4°; (II),$2H_2O$, m.p. 36·5°; (II),$4H_2O$, decomp. 48·0°; 3(III),H_2O, decomp. 50·5°; and (III),$2H_2O$, decomp. 64·0°. W. R. A.

Binary system $NaAlSiO_4$–$CaSiO_4$.—See A., 1942, I, 380.

Thermal analyses with a hot-stage microscope. IV. Contact method for binary systems with incongruent melting compounds and partial miscibility of liquid phases. A. Kofler (*Z. physikal. Chem.*, 1942, **A, 190**, 287—306; cf. A., 1942, I, 263).—The following binary systems have been examined microscopically at various temp. and eutectics and mol. compounds with their thermal characteristics are reported: anthracene–picric acid, p-$C_6H_4(NO_2)_2$–α-$C_{10}H_7{\cdot}NH_2$, and carbazole–1 : 2 : 4 : 6-$C_6H_2Me(NO_2)_3$. The partial miscibility of the liquid phases in the systems $CHPh_3$–m-$C_6H_4(OH)_2$, $(NPh_3)_2$–H_2O, benzil–H_2O, and indole–H_2O has also been studied. J. W. S.

Ternary systems involving *cyclo*hexane, water, and *iso*- and *n*-propyl alcohols. E. R. Washburn, C. E. Brockway, C. L. Graham, and P. Deming (*J. Amer. Chem. Soc.*, 1942, **64**, 1886—1888).—The solubility relationships at 25° for the ternary system containing H_2O, *cyclo*hexane, and $Pr^{\beta}OH$ have been determined. The system containing H_2O, *cyclo*hexane, and $Pr^{\alpha}OH$ has been investigated at 25° and 35°. W. R. A.

System Li_2O–BeO–B_2O_3. I. H. Menzel and S. Sliwinski (*Z. anorg. Chem.*, 1942, **249**, 357—385).—The formation and properties of Li_2O–BeO–B_2O_3 glasses have been studied. Glasses occur in a restricted region of the triangular diagram, between 100% B_2O_3 and ~65% B_2O_3, 25% Li_2O, 13% BeO. Outside this region partly devitrified or definitely cryst. products are obtained. The latter include *Be orthoborate*, $3BeO,B_2O_3$, ρ^{25} 2·4. Data on ρ and n for the glasses, and on their resistance to H_2O vapour and transparency to *X*-rays, are given. F. J. G.

Heat of formation and high-temperature heat content of manganous oxide and manganous sulphate. High-temperature heat content of

manganese. J. C. Southard and C. H. Shomate (*J. Amer. Chem. Soc.*, 1942, **64**, 1770—1774).—At 25° the heats of formation of MnO and $MnSO_4$ are $\Delta H = -92{,}040 \pm 110$ and $-254{,}180 \pm 250$ g.-cal. per mol. The heat contents of Mn, MnO, and $MnSO_4$ have been determined from room temp. to temp. between 811° and 1500° and a transition in Mn at 739° has been found. The increments of heat contents, entropies, and free energies at 100° intervals have been tabulated from these and previous data. (Cf. A., 1942, I, 392.) W. R. A.

Heats of organic reactions. XHI. Heats of hydrolysis of some acid anhydrides. J. B. Conn, G. B. Kistiakowsky, R. M. Roberts, and E. A. Smith (*J. Amer. Chem. Soc.*, 1942, **64**, 1747—1752).—The heats of the hydrolytic reaction have been computed from heats of reaction in solution for straight-chain and 5-membered cyclic acid anhydrides. Ac_2O, $(EtCO)_2O$, $(Pr^{\beta}CO)_2O$, and $(Bu^{\gamma}CO)_2O$ have the same heat of hydrolysis, showing no effect due to Me substitution. In the ring compounds Me substitution alters the heat of hydrolysis considerably. Symmetrical substitution of Me in $(CH_2{\cdot}CO)_2O$ decreases the heat of hydrolysis, whilst unsymmetrical substitution increases it. The heat of hydrolysis is also decreased by the presence of a double bond in the ring. These effects are discussed qualitatively, and similarities to the trend of heats of hydrogenation of 5-membered C ring compounds are indicated. W. R. A.

Entropy of monomeric forms of formic acid and acetic acid. J. O. Halford (*J. Chem. Physics*, 1942, **10**, 582—584).—Combination of the entropy of HCO_2H vapour at its equilibrium v.p. with v.d. data gives $60{\cdot}0 \pm 0{\cdot}3$ for the entropy of monomeric HCO_2H at 25° and 1 atm., and $83{\cdot}1 \pm 0{\cdot}3$ for the dimeric form. In this substance there is an entropy deficiency of $3{\cdot}7 \pm 0{\cdot}3$ units due to hindrance of internal rotation. The val. for AcOH is corr. to $70{\cdot}1 \pm 1{\cdot}0$. A. J. M.

VII.—ELECTROCHEMISTRY.

(A) Limiting equivalent conductances of aqueous potassium chloride between 15° and 40°. (B) Limiting ionic mobilities of univalent ions between 15° and 45°. N. C. C. Li and W. Brüll (*J. Amer. Chem. Soc.*, 1942, **64**, 1544—1547, 1635—1637).—(A) Vals. of Λ of aq. KCl (0·0004—0·1N.) have been measured at 15°, 20°, 22°, 25°, 30°, and 40°. At high dilutions the experimental data follow closely the Onsager limiting slope. Only one empirical const. B is needed at other concns. Between 15° and 40° $\Lambda_0 \propto \theta$. The variation with η is given by $\Lambda_0\eta_0' = r$ ($s < 1$).

(B) Limiting mobilities of $K^{\cdot}$ and Cl' ions at 15°, 25°, 35°, and 45° based on the conductance data of Li and Fang (see above) and the transference data of Allgood *et al.* (A., 1940, I, 324) are tabulated. The limiting transference nos. of aq. NaCl and NaOAc, and the approx. vals. for the limiting ionic mobilities of $Na^{\cdot}$ and OAc' ions, are also given. The transference nos. calc. for NaCl solutions show the necessity of obtaining accurate conductivity data not only at 25°, but also at different temp. W. R. A.

Formal oxidation–reduction potentials of thallous–thallic salts in aqueous hydrochloric acid solutions. Formation of chlorothallate complex ions. R. H. Hughes and C. S. Garner (*J. Amer. Chem. Soc.*, 1942, **64**, 1644—1648).—The oxidation–reduction potentials for Tl^{I}–Tl^{III} oxidation in HCl and in HCl–$HClO_4$ mixtures has been measured. In the mixed acids chlorothallate ions of the type $TlCl_4'$ and $TlCl_4'''$ are postulated. Thermodynamic consts. for the reaction $Tl^{\cdot} + 2H^{\cdot} = Tl^{\cdot\cdot\cdot} + H_2$ have been computed. W. R. A.

Temperature coefficient of electrode potential of iron. L. V. Nikitin (*J. Gen. Chem. Russ.*, 1941, **11**, 146—148).—The potential of Fe anodes in aq. $ZnSO_4$, $ZnSO_4 + H_2SO_4$, $FeSO_4$, or $K_2Cr_2O_7 + H_2SO_4$ varies positively or negatively during subjection of the metal to deforming stresses. These effects are ascribed chiefly to temp. changes. R. T.

Oxidation–reduction potentials of the metmyoglobin–myoglobin system.—See A., 1942, III, 736.

Polarographic researches in non-aqueous medium. H. Cobaltous chloride in methyl alcohol and in a mixed solvent of methyl alcohol and benzene. G. Sartori (*Gazzetta*, 1941, **71**, 263—268; cf. A., 1940, II, 362).—The deposition potential of Co at a Hg cathode from (red) solutions of $CoCl_2$ of varying concn. and LiCl in MeOH follows the Nernst logarithmic equation; dissociation of the $[Co(MeOH)_n]^{\cdot\cdot}$ ion is thus rapid. Solutions in MeOH–C_6H_6 are blue (owing to reduction of dielectric const. by addition of C_6H_6), and deposition from these is regular, as from blue aq. solutions. E. W. W.

Reduction of iodate and bromate at the dropping mercury electrode in neutral and basic media and the effects of salts on current–voltage curves. E. F. Orlemann and I. M. Kolthoff (*J. Amer. Chem. Soc.*, 1942, **64**, 1970—1977).—A relation exists in the reduction of iodate and bromate at the dropping Hg electrode in neutral or alkaline media between the potential, the current ratio, and the concn. of the indifferent cation. This relation does not hold in solutions of NMe_4Br. There is a linear relation between the concn. of the different cations in the solution (with the exception of $NMe_4^{\cdot}$) and the shift of the half-wave potential. The latter is slightly dependent on the drop time. A mechanism for the reduction of iodate and bromate in salt solutions is proposed. For iodate the following species are reduced: KIO_3, $CsIO_3$, $Na_2IO_3^{\cdot}$, $Li_2IO_3^{\cdot}$, $BaIO_3^{\cdot}$, $CaIO_3^{\cdot}$. W. R. A.

Reduction of unsaturated hydrocarbons at the dropping mercury electrode. I. Phenyl-substituted olefines and acetylenes. H. A. Laitinen and S. Wawzonek (*J. Amer. Chem. Soc.*, 1942, **64**, 1765—768).—The polarographic reduction of a series of Ph-substituted olefines and acetylenes has been investigated. The most suitable solvent is a 3 : 1 dioxan–H_2O mixture, with NBu_4I as a supporting electrolyte. Each compound gives a single reduction wave in neutral or alkaline media with a half-wave potential which is independent of p_H. The diffusion current is $\propto$ the hydrocarbon concn. The polarographic method is useful in the detection and determination of olefines and acetylenes with activated double or triple bonds. The half-wave potential is suggested as a measure of the relative activation of ethylenic and acetylenic linkings by substituent groups. Equations of the rising portions of the waves for an olefine and an acetylenic hydrocarbon have been derived, and a reduction mechanism is suggested. The diffusion coeffs. of the hydrocarbons have been calc. from diffusion current data. W. R. A.

VIII.—REACTIONS.

Influence of water vapour on flame gas temperatures. W. T. David and J. Mann (*Nature*, 1942, **150**, 521—522).—For H_2–air flames at any given H_2 content the moist flame gas temp. is 40—50° > the dry flame gas temp. instead of 15° lower (calc.). Quartz-covered Pt wires were used; the Na line reversal method is unreliable. A. A. E.

Radiation from flames. W. T. David (*Nature*, 1942, **150**, 407—408).—Helmholtz' observation that the radiation from CO flames is > that from H_2 flames is attributable to the more rapid cooling of the products surrounding the outer cone of H_2 flames due to more rapid combustion and greater turbulence. Decrease in radiation from the flame on pre-heating the burner gases is similarly explained. A. A. E.

Condition of freshly burnt gases. A. G. Gaydon (*Nature*, 1942, **150**, 481—483).—A review and discussion. It is concluded that the after-burning and other peculiarities of the combustion of dry CO are best explained in terms of vibrationally activated mols., and cannot well be due to CO_2 mols. of abnormal structure. The persistence of radicals and reactive intermediary products of the combustion may explain some of the abnormalities of "live" flame gases. A. A. E.

Oxidation of *n*-butylboron. O. Grummitt (*J. Amer. Chem. Soc.*, 1942, **64**, 1811—1814).—In the presence of dry O_2 *n*-butylboron oxide, $(Bu^{n}BO)_3$, is quantitatively oxidised and depolymerised to monomeric $Bu^{n}BO_2$. There is evidence for the intermediate formation of a peroxidic substance. A suggested reaction mechanism could not be confirmed by rate measurements because the kinetics were complex. $NHPh{\cdot}C_{10}H_7$-β retards the oxidation but quinol does not. W. R. A.

Kinetics of thermal reaction between hydrogen and cyanogen. N. C. Robertson and R. N. Pease (*J. Amer. Chem. Soc.*, 1942, **64**, 1880—1886).—The thermal reaction of H_2 and $(CN)_2$ to give HCN has been studied in a SiO_2 vessel from 550° to 675°. The nature of the surface of the reaction bulb has some influence on the rate. HCN inhibits the reaction. At low temp. the rate is increased by packing, but this has little effect above 625°. The Bodenstein–Lind expression for the combination of H_2 and Br fits the kinetics at 625° fairly well. Evidence is given which favours a radical chain mechanism involving gas-phase propagation by H atoms and CN radicals with chains starting and breaking on the walls. The steps in this process would be analogous to those in the H_2–Br reaction with $(CN)_2$ replacing the Br. W. R. A.

Decomposition of *cyclo*hexene oxide and $\Delta^{1:3}$-*cyclo*hexadiene from the viewpoint of the principle of least motion. F. O. Rice and A. L. Stallbaumer (*J. Amer. Chem. Soc.*, 1942, **64**, 1527—1530).—Org. decomp. from the viewpoint of the principle of least motion should give rise to relatively few single-step reactions. *cyclo*Hexene oxide when heated is rearranged to *cyclo*hexanone and decomposed to H_2O and a hydrocarbon, probably $\Delta^{1:4}$-*cyclo*hexadiene. $\Delta^{1:3}$-*cyclo*-Hexadiene yields H_2 and C_6H_6. W. R. A.

Derivation of general kinetic equation for reaction between ions and dipolar molecules. E. S. Amis and G. Jaffé (*J. Chem. Physics*, 1942, **10**, 598—604).—The Debye–Hückel theory of the ionic atm. is extended to the case of dipoles surrounded by ions, and the theory is combined with Onsager's theory of electric moments of mols. in liquids. The result is applied to the deduction of a general kinetic equation for reaction between ions and dipolar mols. which is in satisfactory agreement with experimental data on the dependence of the rate of reaction on concn. and dielectric const. A. J. M.

Variation of reaction mechanism with surface conditions in reduction of silver salts by hydroxylamine. T. H. James (*J. Chem. Physics*, 1942, **10**, 464—468).—The effects of ageing of the ppt., addition of gelatin or pinacyanol, admixture of AgBr with the ppt., and presence of CNS′, Br′, and I′ on the reduction of AgCNS by NH_2OH at p_H 10·2—10·8 have been examined. The proportions of N_2 and N_2O in the gaseous product depend markedly on the effect of the above factors on the surface condition of the AgCNS. Small additions of Br′ or I′ greatly decrease the yield of N_2O; ageing a fresh ppt. increases it. The results are consistent with the formation of N_2O by uncatalysed reduction of Ag^+ by NH_2OH, and of N_2 by the Ag-catalysed reaction involving adsorption of Ag^+. L. J. J.

Solvent effects on the kinetics of ionic reactions and the choice of the concentration scale. H. G. Davis and V. K. LaMer (*J. Chem. Physics*, 1940, **10**, 585—597).—The mol fraction scale is preferable to the vol. molar scale for the calculation of kinetic data, such as the relations between variables when solvents are changed. The reaction between S_2O_3'' and $CH_2Br{\cdot}CO_2'$ is investigated. Temp. coeffs. have been determined for the reaction in several isodielectric solvents, and are discussed as criteria of electrostatic and non-electrostatic effects. The solubility of TlCl has been determined; it does not depend alone on the dielectric const. The use of the mol. fraction scale also gives simple results in connexion with the effect of η on the quenching of fluorescence. A. J. M.

Mutual transformation of sulphato- and aquo-pentammino-cobaltic sulphates in presence of dilute sulphuric acid. B. Adell (*Z. anorg. Chem.*, 1942, **249**, 251—262).—Equilibrium consts. and velocity coeffs. are recorded for the reaction $[Cr(NH_3)_5SO_4]^+ + H_2O \rightleftharpoons [Cr(NH_3)_5H_2O]''' + SO_4''$ at 25°. F. J. G.

Hydration of *iso*butene in dilute nitric acid. G. H. Lucas and L. P. Hammett (*J. Amer. Chem. Soc.*, 1942, **64**, 1938—1940).—The distribution of products in the reaction of $Hg(NO_3)_2$ with $Bu^{\gamma}Cl$ in various dioxan–H_2O mixtures has been studied. The rate of disappearance of *iso*butene in dil. HNO_3 decreases rapidly with increasing amount of dioxan. Experimental data show that $Bu^{\gamma}NO_3$ is not an intermediate in the hydration of *iso*butene in dil. HNO_3 and that the pronounced acceleration produced by NO_3' ion is a salt effect. W. R. A.

Rate and mechanism in the reactions of *tert.*-butyl nitrate and of benzyl nitrate with water and with hydroxyl ion. G. R. Lucas and L. P. Hammett (*J. Amer. Chem. Soc.*, 1942, **64**, 1928—1937).—The reactions of $Bu^{\gamma}O{\cdot}NO_2$ and of $CH_2Ph{\cdot}O{\cdot}NO_2$ (**I**) with H_2O and NaOH have been studied in various dioxan–H_2O mixtures. The reaction of $Bu^{\gamma}O{\cdot}NO_2$ gives alcohol and olefine in proportions similar to those in which they are formed from Bu^{γ} halides, and since the energies of activation of nitrate and halide reactions are almost identical, the same mechanism is strongly indicated. No appreciable reaction with OH′ ion or catalysis by acids has been noticed. OH′ ion retards, whilst ClO_4' ion accelerates and other ions have intermediate effects which parallel their effect on the activity of H_2O in the medium. This weakens the direct kinetic argument of Ingold and Hughes and of Beste and Hammett for a free carbonium ion intermediate in solvolytic reactions. The solvolysis of (**I**) to $CH_2Ph{\cdot}OH$ has a much higher energy and entropy of activation than the analogous reactions of CH_2PhCl, suggesting that the reaction of (**I**) is more a true solvolysis than a displacement of anion by H_2O mol. than is the reaction of CH_2PhCl. OH′ ion gives a considerable acceleration, but acids have no effect. The conversion of (**I**) into PhCHO and nitrite also shows a kinetically first-order reaction of (**I**) and a second-order reaction with OH′ ion, both being completely suppressed by the addition of quinol. W. R. A.

Velocity of transformation of hydroxymethylene ketones into benzene derivatives. R. Kaushal, (Miss) S. Sovani, and S. S. Deshapande (*J. Indian Chem. Soc.*, 1942, **19**, 107—116).—Determinations of the residual ketone at various time intervals indicate that the condensation of $COMe{\cdot}CH_2{\cdot}CHO$ (**I**) and $CH_2Bz{\cdot}CHO$ (**II**) in presence of a small amount of HCl or H_2SO_4 to yield C_6H_6 derivatives is a termol. reaction. The corresponding compound (**III**) formed by interaction of COMeEt and HCO_2Et in the presence of Na undergoes no condensation. The reaction with (**I**) and (**II**) is attributed to enolisation to the $CH{:}C(OH)$ grouping, so it is inferred that (**III**) has the structure $COMe{\cdot}CO{\cdot}CHMe{\cdot}CHO$. J. W. S.

Co-polymerisation of alkyl acrylates and maleates.—See A., 1942, II, 391.

Chemical war materials. XXV. Hydrolysis of compounds with a structure similar to that of mustard gas. H. Mohler and J. Hartnagel (*Helv. Chim. Acta*, 1942, **25**, 859—863).—The rates of hydrolysis of various Cl-substituted ethers and thioethers have been measured at 20°. α-Cl-compounds are much more rapidly hydrolysed than are β-Cl-compounds. $(Cl{\cdot}[CH_2]_2)_2O$ (**I**) is much less rapidly hydrolysed than is $(Cl{\cdot}[CH_2]_2)_2S$ (**II**), this being attributed to the sharing of all electron pairs of the O atom of (**I**) in aq. or EtOH solution by co-ordination, thus making it similar to $(Cl{\cdot}[CH_2]_2)_2SO$ and $(Cl{\cdot}[CH_2]_2)_2SO_2$. It is suggested that (**II**) has a greater vesicant action than the other compounds investigated because it is stable enough to penetrate the skin but then undergoes hydrolysis. J. W. S.

Autoxidation of oxygen-active acids. IV. Refractometric analyses of addition of oxygen to the methyl esters.—See A., 1942, II, 392.

Theory of oxidation and tarnishing of metals. II. Growth laws under more general conditions.—See B., 1942, I, 483.

Catalysis of the thermal decomposition of acetaldehyde by hydrogen sulphide. W. L. Roth and G. K. Rollefson (*J. Amer. Chem. Soc.*, 1942, **64**, 1707—1711).—The thermal decomp. of MeCHO, catalysed by H_2S, yields CO and CH_4 in equiv. amounts and there is no net loss of H_2S. The decomp. is homogeneous and initial rates, given by $-d[MeCHO]/dt + k_1[H_2S][MeCHO] + [H_2S][MeCHO]/(1 + k_2[MeCHO])$, increase rapidly with rising temp. in the range 713—787° K. The consts. of the equation have been evaluated. Analysis failed to give any indication of intermediate steps in the catalysis and addition of H_2, S, COS, MeSH, Me_2S, and H_2O gave results indicating that none of them act as important intermediates in the reaction. Admixture of NO and H_2S gave a more powerful catalyst than either used separately. W. R. A.

Detection and inhibition of free radical chain reactions. I. Comparison of nitric oxide and propylene as inhibitors. II. Inhibition curves for the thermal decomposition of diethyl ether in presence of propylene. III. Inhibition curves for the thermal decomposition of propaldehyde in presence of propylene. IV. Influence of propylene and of nitric oxide on the thermal decomposition of acetaldehyde. V. Comparison of a series of aldehydes. J. R. E. Smith and C. N. Hinshelwood (*Proc. Roy. Soc.*, 1942, **A**, **180**, 237—241, 242—243, 244—246, 246—252, 253—256).—I. The reduction by C_3H_6 of the rate of pressure increase in the decomp. of EtCHO at 550° is shown to represent a true inhibition of the reaction, and not an induced polymerisation of the C_3H_6. With EtCHO and with Et_2O the limiting vals. to which the decomp. rates are reduced by NO and C_3H_6 are the same. It is concluded that these rates are probably those of independent non-chain processes, rather than those characteristic of stationary states where the inhibitor starts and stops chains with equal efficiency.

II. The curves showing the inhibition of Et_2O decomp. as a function of [NO] are independent of the initial pressure of Et_2O. With C_3H_6 the initial pressure of Et_2O strongly affects the inhibition curve. The contrast is explained by a difference in the ease with which two types of radical combine with NO and C_3H_6 respectively.

III. The inhibited reaction is of an order between the first and the second. The inhibition curves, like those of the Et_2O–C_3H_6 system, depend on the initial pressure of EtCHO.

IV. The rate of pressure increase during decomp. is diminished by C_3H_6 and direct chemical analysis shows that this is due to a real decrease in the reaction rate. Re-examination of the effect of NO shows that an inhibition may have been masked by a superimposed catalytic effect.

V. The hypothesis that C_3H_6 and NO repress radical chains, leaving an independent mol. reaction, gives a coherent picture of the decomp. mechanism of simple aldehydes. G. D. P.

Catalysed polymerisation of methyl methacrylate in the liquid phase. R. G. W. Norrish and R. R. Smith (*Nature*, 1942, **150**, 336—337).—Much of the increase in reaction rate observed during polymerisation cannot be attributed to rise in temp., but is probably not due to increase in the rate of initiation of centres since the chain length of polymeride increases. Results for polymerisation in presence of diluents support the view that increasing bulk viscosity is responsible for the rise in rate and chain length in that it decreases the rate " constant " of termination of chains. A. A. E.

Peroxide-catalysed interaction of oxalyl chloride with the side-chains of aralkyl hydrocarbons. Relative reactivity of free radicals.—See A., 1942, II, 393.

Catalysis of dichromate–hydriodic acid reaction by oxalate ion. C. R. Viswanadham and G. Gopalarao (*Current Sci.*, 1942, **11**, 102—103).—C_2O_4'' catalyses the reaction between Cr_2O_7'' and I′, and in presence of C_2O_4'' (~0·01N.) $K_2Cr_2O_7$ can be determined iodometrically at low [H·]; reactions between C_2O_4'' and I or Cr_2O_7'' do not interfere. Citrates and tartrates are less effective catalysts; succinates have no effect. A. J. E. W.

Autoxidation of manganous hydroxide. A. R. Nichols, jun., and J. H. Walton (*J. Amer. Chem. Soc.*, 1942, **64**, 1866—1870).—The rate of autoxidation of $Mn(OH)_2$ in ammoniacal solution decreases with increasing $[NH_4Cl]$ but an induction period exists when $[NH_4Cl]$ is high. The reaction is accelerated and the induction period eliminated by adding powdered MnO_2, SnO_2, Fe_2O_3, Pb_3O_4, ground glass, and diatomaceous earth. In the presence of PbO_2 no autoxidation of Mn^{II} occurs. $CoCl_2$ and $CuCl_2$ accelerate the reaction, whilst glycerol, dextrin, and I retard it. A large no. of other substances have no effect. The autoxidation of $Mn(OH)_2$ does not induce the oxidation of $Na_2C_2O_4$, HCO_2Na, Na_2AsO_3, $NaNO_2$, or $CH_2{:}CH{\cdot}CH_2{\cdot}OH$. The autoxidation by air is much slower and less complete than that

by pure O_2. The autoxidation of $Mn(OH)_2$, pptd. by fixed alkali, is very rapid, and the product depends on the proportions of Mn^{++} ion and alkali and the temp. The *X*-ray diffraction patterns of the products have been studied. The autoxidation of $Mn(OH)_2$, pptd. by $N([CH_2]_2{\cdot}OH)_3$, is very slow, and does not display the induction period encountered in ammoniacal solution. A mechanism has been proposed to account for the results. W. R. A.

Olefine rearrangements. Equilibrium of olefines from pinacolyl alcohol. R. K. Smith (*J. Amer. Chem. Soc.*, 1942, **64**, 1733—1735).—From thermal data on $\beta\gamma$-dimethyl-Δ^{α}- and -Δ^{β}-butene, $\gamma\gamma$-dimethyl-Δ^{α}-butene, and $\beta\beta$- and $\beta\gamma$-dimethylbutane, the equilibrium mixture of these olefines in the dehydration products of $CHMeBu^{\gamma}{\cdot}OH$ has been calc. Their rearrangement using acidic catalysts agrees with thermodynamic vals. Comparison of dehydrations with acidic catalysts and with those which do not furnish $H^{\cdot}$ ions indicates that the latter act by removing an equiv. of H_2O but do not affect the isomerisation of compounds formed. $H^{\cdot}$ ions catalytically promote isomerisation. W. R. A.

Ageing of sodium chloride precipitates. C. Racz (*Compt. rend.*, 1942, **214**, 30—31).—The activating effect of solid NaCl on crystallo-luminescence of the aq. solution (*ibid.*, 1941, **212**, 604) decreases on keeping, the ageing process having an apparent activation energy of 11·5 kg.-cal. The effect of the solid is ascribed to partly-developed nuclei on the crystal faces. A. J. E. W.

Mechanism of the catalytic conversion of para-hydrogen on nickel, platinum, and palladium. A. Farkas and L. Farkas (*J. Amer. Chem. Soc.*, 1942, **64**, 1594—1599).—The catalytic conversion of p-H_2 on evaporated layers of Ni, Pd, and Pt at room temp. at ~0·01 mm. has been investigated. A stable layer of H_2 on the catalysts, which is not removed by pumping at room temp. but readily exchanges with mol. H_2 and D_2, gives a measure of the no. of active centres on the catalyst and $\approx 10^{14}$—10^{15} per sq. cm. The rate of exchange $\approx$ rate of p-H_2 conversion on Ni, but is smaller on Pd and Pb. Possible mechanisms are discussed. W. R. A.

Catalysis by alloys. VII. Hydrogenation activity of mixed nickel–copper catalysts. G. Rienäcker and R. Burmann (*J. pr. Chem.*, 1941, [ii], **158**, 95—108).—The efficiency of mixed crystal Ni–Cu catalysts for hydrogenation of $CHPh{:}CH{\cdot}CO_2H$ in aq. EtOH is increased by suspension on kieselguhr (9 pts.) if the Ni content of the catalyst is $<95\%$ for equal wts. of catalyst or $<40\%$ for equal wts. of metals, but for lower Ni contents the efficiency is unaffected or decreased. The mixed-crystal nature of the catalysts is proved by *X*-ray spectra. This supports the view that catalysts of high Ni content have a few spots of high activity, their no. being increased by the support, whereas those of low Ni content have many spots of low activity. R. S. C.

Recovery of nickel catalysts poisoned during desulphurisation of Ischimbaev crude oils.—See B., 1942, I, 452.

Chemical action of electric discharges. XXIX. Peculiarities of the spectra of arcs operating at high or low frequency in gaseous mixtures containing water vapour, nitrogen, and oxygen. B. P. Susz, H. Hoefer, and E. Briner. **XXX. Influence of diluent gases in the production of ozone by an ozoniser discharge in oxygen.** E. Briner and (Mlle.) B. Bever (*Helv. Chim. Acta*, 1942, **25**, 889—892, 900—906).—XXIX. The emission spectrum of a high- or low-frequency arc in mixtures of N_2, O_2, and H_2O vapour shows the presence of H, N_2^+, NO, OH, and CN particles. The frequency of the arc has little effect on the spectrum. The observations support the view that fixation of N occurs through the production of NO from N_2^+ and subsequent reaction of NO with OH to yield HNO_2.

XXX. The yields of O_3 obtained by the action of an ozoniser discharge in pure O_2 and in O_2 containing various inert gases have been measured. The yields are > would be expected if the added gases acted only as diluents and these gases appear to facilitate the production of O_3 in the order $CO_2 > N_2 > He > Ne > A$. J. W. S.

Influence of diluent gases in the production of ozone by ultra-violet radiation. E. Briner and G. Papazian [with H. Karbassi] (*Helv. Chim. Acta*, 1942, **25**, 892—900).—The yield of O_3 obtained during irradiation with a Hg-vapour lamp is much greater when the O_2 is mixed with CO_2 than when mixed with N_2. With a mixture containing 20% of CO_2 the yield is slightly > in pure O_2. This behaviour is interpreted by assuming that the diluent mols. absorb energy which would otherwise tend to cause decomp. of the O_3 mols. J. W. S.

Oxidation processes. XIV. Effect of silver on the autoxidation of photographic developing agents. A. Weissberger and D. S. Thomas, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 1561—1567).—Absorption of O_2 by quinol at various rates of shaking has been investigated in order to re-determine the conditions under which the concn. of O_2 in the liquid phase remains const. The rate of autoxidation of quinol between p_H 7 and 8·2 increases with $[OH']^{0\cdot5}$ and is only very slightly accelerated by Ag. Autoxidation of o-$C_6H_4(OH)_2$, p-$NH_2{\cdot}C_6H_4{\cdot}OH$, and glycine is only slightly accelerated by Ag, indicating that the catalysis suggested by Volmer (B., 1921, 239) is unlikely. On the other hand the autoxidation of p-$C_6H_4(NH_2)_2$ and p-$NH_2{\cdot}C_6H_4{\cdot}NMe_2$ is considerably catalysed. Addition of Ag diminishes greatly the total amount of O_2 absorbed by developing agents in alkaline solutions on account of the catalytic effect of Ag on reactions of peroxide formed in the autoxidation. W. R. A.

Acyclic acids. A. da Silveira Ramos (*Anais Assoc. Quim. Brasil*, 1942, **1**, 55—72).—The sensitivity to light of AgOAc, $EtCO_2Ag$, and $Pr^{\alpha}CO_2Ag$ is analogous to the ultra-violet absorption of the corresponding acids. F. R. G.

Vapour-phase photo-decomposition of methyl formate. D. H. Volman (*J. Amer. Chem. Soc.*, 1942, **64**, 1820—1821).—MeOH is formed by the photolysis of HCO_2Me. The decomp. quantum yield for the photolysis is ~0·75 for an ester pressure of 75·0 mm. at 25°. The reaction products have the following average % vals.: H_2, 9·5; CO, 40·0; CH_4, 6·0; CO_2, 14·8; C_2H_6, 1·1; MeOH, 29·0. W. R. A.

Photochemical formation of dichloro- and dibromo-ethane from ethylene and chlorine or ethylene and bromine. H. Schmitz, H. J. Schumacher, and A. Jäger (*Z. physikal. Chem.*, 1942, **B**, **51**, 281—305).—The photochemical reaction of C_2H_4 with Cl_2 between 25° and 40° at 4538 A. is homogenous and occurs according to $d[C_2H_4Cl_2]/dt = k[I_{abs.}]^{1/2}[Cl_2][C_2H_4]^{1/2}$. $C_2H_4Cl_2$ is formed almost quantitatively. The quantum yield, γ, is ~10^6. The reaction is very sensitive to the presence of impurities and is inhibited by O_2. The temp. coeff. is ~1 per 10°. The reaction of C_2H_4 with Br_2 between 60° and 80° at 5460 A. is homogenous and gives $C_2H_4Br_2$ almost quantitatively. At low pressures $d[C_2H_4Br_2]/dt = k_1 I_{abs.} \cdot P[C_2H_4][Br_2]/([Br_2] + k')$, at high pressures $d[C_2H_4Br_2]/dt = k_2(I_{abs.}/P)^{1/2}[C_2H_4][Br_2]/([Br_2] + k')$, where P is the total pressure. The pressure influence of inert gases is sp. O_2 inhibits the reaction; no measurable oxidation of C_2H_4 occurs. The temp. coeff. is small and negative. γ is ~10^5. Mechanisms are proposed. O. D. S.

Photochemical production of branched carbon chains from ether and formaldehyde.—See A., 1942, II, 389.

Effect of light on riboflavin solutions.—See A., 1942, III, 909.

Effect of strong electric fields on radiochemical decomposition of gaseous ammonia. M. J. McGuinness, jun., and H. Essex (*J. Amer. Chem. Soc.*, 1942, **64**, 1908—1911).—Ion yields in the α-ray decomp. of gaseous NH_3 at 25° and 20 cm. have been determined over a wide range of field strengths. No ion recombination occurs in the absence of a field. The increase in ion field at high field strengths is attributed to electron collisions, which are assumed to result in direct and resonance splitting of the NH_3 mol. The splitting of an NH_3 mol. on collision with an electron does not usually involve electron attachment. W. R. A.

Ionisation and dissociation by electron impact: ethane, *n*- and *iso*-butane. D. P. Stevenson and J. A. Hipple, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 1588—1594).—The dissociation products of C_2H_6 and *n*- and *iso*-C_4H_{10} as a result of electron impact have been examined by the mass spectrometer and their relative abundances are discussed as a function of the energy of the bombarding electrons. The crit. potentials of some of the processes have been measured and their significance is discussed. Limitations of the mass spectrometer as an analytical tool are considered. W. R. A.

IX.—METHODS OF PREPARATION.

Isomorphous kinds of apatite. P. Dihn and R. Klement (*Z. Elektrochem.*, 1942, **48**, 331—333).—By sintering the components [$Ca_3(PO_4)_2$, Ca_2SiO_4, $CaSO_4$, CaF_2, Na_2SO_4] at 1200°, substances having the apatite structure but with PO_4''' partly or completely replaced by SiO_4'''' and/or SO_4'' may be obtained. If $SiO_4'''' + SO_4''$ replaces $2PO_4'''$, no change in the cations is necessary; otherwise the charges must be equalised by partly replacing $Ca^{\cdot\cdot}$ by $Na^{\cdot}$. In some instances structures with 11 metallic ions instead of 10, and the apatite structure, may be obtained, and in many instances by working in presence of H_2O vapour F' may be replaced by OH'. F. J. G.

Is carbonate-apatite formed in aqueous systems? R. Klement, F. Hüter, and K. Köhrer (*Z. Elektrochem.*, 1942, **48**, 334—336).—Ppts. obtained from aq. solutions containing $Ca^{\cdot\cdot}$ and PO_4''' in presence of varying quantities of CO_2'' are mixtures of hydroxyl-apatite and $CaCO_3$. Carbonate-apatite is not formed under these conditions. F. J. G.

Processes of transformation and reaction occurring before and during the formation of zinc iron spinel from β-zinc hydroxide containing carbonate and γ-iron hydroxide. II. Thermal behaviour of the mixture of labelled β-zinc hydroxide and γ-iron hydroxide. W. Schröder [with H. Schmah] (*Z. Elektrochem.*, 1942, **48**, 301—311).—The changes occurring when γ-FeO·OH (**I**) and β-$Zn(OH)_2$ (**II**) containing Ra-Th and a little CO_2 are heated together have been studied by the emanation (**III**) method. Merely on mixing there is a marked increase in the yield of (**III**). This is because

atoms of (III) stopped by collision with (I) are more easily given up, owing to its lower degree of crystallisation, than those stopped by (II). On heating the dissociation of (II) and of $ZnCO_3$ is not affected by the presence of (I). Recrystallisation of ZnO begins at ~120° and the *X*-ray interferences of γ-Fe_2O_3 appear at 400° and those of α-Fe_2O_3 at 500°. Change in the yield of (III) in this temp. range corresponds with the formation of the unstable intermediate stage, and there is a sharp max. of the yield of (III) at 730°. Above this temp. recrystallisation of $ZnFe_2O_4$ occurs. F. J. G.

Pure mercury. E. Wichers (*News Ed. Amer. Chem. Soc.*, 1942, **20**, 1111).—Observation of the surface of Hg is the most sensitive method of determining purity, as "tailing" or film formation occurs with 0·1 p.p.m. of base metals. Details of purification methods are given. D. F. R.

Mercury methyl iron tetracarbonyl. F. Hein and E. Heuser (*Z. anorg. Chem.*, 1942, **249**, 293—298).—*Hg Me Fe tetracarbonyl*, $(HgMe)_2Fe(CO)_4$, has been obtained by the interaction of a solution of $Fe(CO)_4H_2$ in aq. $Ca(OH)_2$ with aq. HgMe·OH. It has m.p. 100—102° (slight decomp.), is sol. in org. solvents but insol. in H_2O, and when kept or warmed undergoes a slow disproportionation to $HgMe_2 + HgFe(CO)_4$. F. J. G.

Constitution of mannitozirconic and mannitoferric acids. A. Tchakirian (*Compt. rend.*, 1942, **214**, 27—29; cf. A., 1940, I, 79).—The ppt. obtained on addition of NaOH to aq. $ZrOCl_2$ containing mannitol (I) is sol. in a slight excess of NaOH, owing to formation of a complex with the approx. composition $[Zr_{10}O_{21}(C_6H_{14}O_6)_n]''$. $[\alpha]$ for the solutions is max. with $[(I)]/[ZrOCl_2] \leqslant 2$; the solutions exhibit mutarotation. Other polyhydroxylic compounds give similar results. $[Fe_{18}O_{27}(C_6H_{14}O_6)_n]''''$ is similarly formed, and may be used to separate Fe from In etc. The Zr complex is decomposed by addition of aq. NH_3 to a boiling solution acidified with HCl, but boiling with Cu or Fe^{II} carbonate is necessary with the Fe complex. A. J. E. W.

Preparation and properties of potassium oxalatostannate. H. H. Willard and T. Y. Toribara (*J. Amer. Chem. Soc.*, 1942, **64**, 1759—1761).—Sn is dissolved directly in $H_2C_2O_4$ using H_2O_2 as an oxidising agent. Cryst. *K oxalatostannate* has the formula $K_6Sn_2(C_2O_4)_7,4H_2O$. The titration of a solution of K oxalatostannate with KOH has been followed by p_H measurements. The solubility relations in the system $K_2C_2O_4$–$Sn(C_2O_4)_2$–H_2O at 25° have been determined; the only solid phases present in the region of C_2O_4 : Sn ratio >3·5 are $K_6Sn_2(C_2O_4)_7,4H_2O$ and $K_2C_2O_4,H_2O$. W. R. A.

Complex dioxalatothiometastannates. H. H. Willard and T. Y. Toribara (*J. Amer. Chem. Soc.*, 1942, **64**, 1762—1765).—*K$_2$ dioxalatothiometastannate*, $K_2SnS(C_2O_4)_2,2H_2O$ (I) has been isolated. It is stable enough to allow removal of all H_2O of hydration. The solubilities of (I) in H_2O have been measured at 0° and 25°, and the p_H of aq. solutions of various concn. has been determined. The reactions of an aq. solution of (I) with various cations have been investigated. Attempts have been made to determine the concn. of the sulphide ion by e.m.f. measurements in solution of (I) with a Ag–Ag_2S electrode. W. R. A.

Lead oxides. VI. Effect of grinding on the *X*-ray diffraction patterns of mixtures containing lead oxides. G. L. Clark and S. F. Kern (*J. Amer. Chem. Soc.*, 1942, **64**, 1637—1641).—When PbO_2 is ground with either red (tetragonal) or yellow (orthorhombic) PbO the characteristic *X*-ray diffraction lines of PbO disappear, but when PbO is ground with an abrasive the lines persist. No oxidation of PbO to PbO_2 occurs, and formation of a solid solution of PbO in PbO_2 or a compound is unlikely. CO_2 absorption is abnormally high after grinding the oxides in air, indicating increased activity of PbO when produced in the distorted form. The diffracting power of PbO is diminished by grinding with $PbSO_4$, but with PbI_2 it persists owing to the lubricating and protecting action of PbI_2 on PbO which prevents distortion of PbO. W. R. A.

Production of lead chromate from lead oxide.—See B., 1942, II, 410.

Corrosion of lead and iron by solutions of potassium chloride containing sodium chloride, potassium chlorate, and sodium hydroxide.—See B., 1942, I, 481.

Salts and complex compounds of nitrilotriacetic acid. H. Brintzinger and G. Hesse (*Z. anorg. Chem.*, 1942, **249**, 299—307).—The following *compounds* derived from nitrilotriacetic acid, $N(CH_2{\cdot}CO_2H)_3$, (H_3R), are described: $UO_2HR,5H_2O$; FeR,H_2O; $H_4[NiR_2],2H_2O$; $H_4[CuR_2],2H_2O$; $Cu_2[CuR_2],7H_2O$. F. J. G.

Condensed phosphoric acids. P. Bonneman-Bémia (*Ann. Chim.*, 1941, [xi], **76**, 395—477).—Of the compounds $Na_4P_2O_7$,$nNaPO_3$ possible, only $Na_5P_3O_{10}$ (I) could be obtained by heating $Na_4P_2O_7$ with $NaPO_3$. Attempts to prepare higher members of the series resulted in mixtures. (I) has been identified by its *X*-ray and Raman spectra and cryoscopically in $Na_2SO_4.10H_2O$. It is formed at a lower temp. by heating NaH_2PO_4, Na_2HPO_4 and NH_4NO_3, or $NaRHPO_4$ or NaR_2PO_4 (R = Me or Et). (I) forms *hydrates*, $Na_5P_3O_{10},6H_2O$ and $Na_5P_3O_{10},8H_2O$, which lose H_2O at ~120°, reverting to $Na_4P_2O_7$ and $NaPO_3$. With H_2O_2 it yields the *compound*, $Na_5P_3O_{10},2H_2O_2,H_2O$. The *compounds*, $Na_3ZnP_3O_{10},11{\cdot}5H_2O$, $Na_8Pb(P_3O_{10})_2,14H_2O$, $Pb_5(P_3O_{10})_2$, $Na_3CdP_3O_{10},12H_2O$, $NaCd_2P_3O_{10},7H_2O$, $NaCa_2P_3O_{10},4H_2O$, $NaSr_2P_3O_{10},7H_2O$, $Sr_5(P_3O_{10})_2$, $Na_2CrP_3O_{10},6H_2O$, $Mn_5(P_3O_{10})_2$, $NaBe_2P_3O_{10},5H_2O$, and $Be_5(P_3O_{10})_2$, have been prepared from (I) by double decomp. $K_5P_3O_{10}$ is also described. The existence of *A*, *A'*, and *B* forms of $(NaPO_3)_3$ and of $(NaPO_3)_4$ has been confirmed. $(NaPO_3)_4$ passes into $(NaPO_3)_3$ when heated at >350°. $(NaPO_3)_3$ could not be prepared by the method of Travers and Chu (A., 1934, 854) but has been obtained by heating $NaRHPO_4$ at low temp. It is more reactive than $(NaPO_3)_3$ and tends to absorb H_2O yielding $Na_2H_2P_2O_7$. Both *A* and *B* forms of $(NaPO_3)_3$ with H_2O_2 yield the same stable *compound* $(NaPO_3)_3,H_2O_2$. No insol. $(NaPO_3)_3$ is obtained on heating $NaRHPO_4$ but $KEtHPO_4$ after heating at 500° yields a product of approx. composition $(KPO_3)_8$. J. W. S.

Aquo-ammono-phosphoric acids. III. *N*-Substituted derivatives of phosphoryl and thiophosphoryl triamide as hydrogen bonding agents. L. F. Audrieth and A. D. F. Toy (*J. Amer. Chem. Soc.*, 1942, **64**, 1553—1555).—*Phosphoryl triamides* have been prepared from NH_2Ph, $CH_2Ph{\cdot}NH_2$, $NHPh{\cdot}NH_2$, morpholine, *o*- and *p*-$C_6H_4Me{\cdot}NH_2$, *cyclo*hexylamine, and *p*-phenetidine, and *thiophosphoryl amides* of piperidine, morpholine, and *cyclo*hexylamine. These amides are much more sol. in $CHCl_3$ than in CCl_4, denoting that their O and N atoms are capable of acting as donor atoms in solvents like $CHCl_3$ with which they form H-bonds. W. R. A.

Cyanates and thiocyanates of phosphorus, arsenic, and antimony. H. H. Anderson (*J. Amer. Chem. Soc.*, 1942, **64**, 1757—1759).—*Phosphoryl* iso*cyanate*, $PO(NCO)_3$, *arsenic* iso*cyanate*, $As(NCO)_3$, and *antimony* iso*cyanate*, $Sb(NCO)_3$, have been prepared by the action of Ag (*iso*)cyanate with the appropriate chloride. Thermal transformations of these volatile *iso*cyanates into the corresponding non-volatile cyanates have been observed. Phosphoryl thiocyanate has been isolated. As thiocyanate, provisionally reported by Miquel, is non-volatile. The apparent regularity of b.p. has been observed, and various physical properties have been quantitatively investigated. W. R. A.

Physico-chemical study of antimonic acid. E. Buchholz and H. Viehweger (*Kolloid-Beih.*, 1940, **51**, 141—198).—Electrolyte-free solutions of antimonic acid (I) are prepared by the action of aq. HCl on the sparingly sol. $AgSbO_3,3H_2O$, obtained from $K_2H_2Sb_2O_7$ and $AgNO_3$; immediate filtration of the reaction mixture yields a solution containing up to 6·3 g. of Sb_2O_5 per l. Solutions of (I) are unstable and undergo progressive aggregation. Conductometric and potentiometric titrations with KOH indicate the formation of compounds $K_2O : Sb_2O_5 = 1 : 3$ and $2 : 3$; with increasing dilution the ratio 1 : 1 is approached. Glycerol and mannitol form strongly ionised complex acids with (I), and in presence of either a sharp end-point is obtained at $K_2O : Sb_2O_5 = 1 : 1$. F. L. U.

Anhydrous tantalum tribromide. R. C. Young and T. J. Hastings, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 1740).—A Pyrex tube (100 cm. long × 37 mm. diameter) containing at one end $TaBr_5$ was heated in the "middle third" at 700°. H_2 was passed over the $TaBr_5$ and a mixture of H_2 and $TaBr_5$ was carried into the heated zone. Reduction products and unchanged $TaBr_5$ were collected. The grey-green reduction product was $TaBr_3$, which reacts with H_2O and alkali, in absence of air, to yield H_2 to an extent corresponding with the change $Ta^{III} \rightarrow Ta^{IV}$. A brown oxide, $TaO_2,2H_2O$, is formed and slowly oxidises to Ta_2O_5. W. R. A.

Action of sulphur trioxide and oleum on chloroform. E. Mazurs (*Z. anorg. Chem.*, 1942, **249**, 278—280).—Oleum of the composition $H_2S_2O_7 + SO_3$ reacts with $CHCl_3$ thus: $CHCl_3 + H_2S_2O_7 + SO_3 = CO + 3ClSO_3H$. With higher $[SO_3]$, $S_2O_5Cl_2$ is also formed, whereas with lower $[SO_3]$, H_2SO_4 is formed. F. J. G.

Borides of molybdenum and tungsten. F. Halla and W. Thury (*Z. anorg. Chem.*, 1942, **249**, 229—237).—Mo and W borides may be obtained by the aluminothermal process. WB_2 has ρ_4^{16} ~13·5; the powder photograph is consistent with either of two structures with *a* 6·35, *c* 16·4 A. and 24 mols. in the unit cell or *a* 8·24, *c* 15·60 A. and 36 mols. in the unit cell. $Mo_7Al_6B_7$ is described. It has *a* 7·03, *c* 5·76 A., ρ_4^{15} 5·85, and one mol. in the unit cell. F. J. G.

Reaction of chlorine dioxide. Formation of the compound ClO_2F. H. Schmitz and H. J. Schumacher (*Z. anorg. Chem.*, 1942, **249**, 238—244).—The *compound* ClO_2F is obtained by direct union of F_2 and ClO_2 diluted with N_2 at 0°. It has b.p. ~−6°, m.p. ~−115°. F. J. G.

Action of sodium silicate on manganous salts in solution. E. A. Dancaster (*J.C.S.*, 1942, 581).—When solutions of $MnSO_4$ or $MnCl_2$ are treated with Na silicates, ppts. of variable composition are obtained. They consist of mixtures of SiO_2 and $Mn(OH)_2$ formed by the interaction of Mn salts with NaOH derived from the hydrolysis of Na silicates. C. R. H.

X.—ANALYSIS.

Electrographic analysis.—See B., 1942, I, 484.

Standard solutions. R. L. Vandaveer (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 650—653).—The work of Conroy on H_2SO_4, King on HCl, Deal on KCNS, and Johnson on $Na_2S_2O_3$ (following abstract, and below) is reviewed and recommendations are made. A. A. E.

Constant-boiling hydrochloric acid [as an acidimetric standard]. W. H. King (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 653—659).—The air-wt. of const.-boiling HCl required to give 1 equiv. wt. $= (P+7680)/46{\cdot}8386$, where P is the barometric pressure (540—780 mm.) in mm. of Hg, corr. to 0°. Collaborative determinations gave satisfactory results. A. A. E.

Electrometric titration of acids [in foods].—See B., 1942, III, 243.

Acidimetric determination of [alkali] chloride. W. Hurka (*Z. anal. Chem.*, 1941, **123**, 165—168).—Cl' is pptd. by addition of Ag_2SO_4, leaving the alkali as alkali sulphate, which is pptd. by means of aq. $Ba(OH)_2$, yielding an equiv. amount of alkali hydroxide. The excess of $Ba(OH)_2$ is pptd. by means of $(NH_4)_2CO_3$ and NH_3, and after boiling to remove NH_3, the alkali carbonate is titrated with 0·1N-HCl (Me-orange). Results are satisfactory for a consumption of 0·1N-HCl > 20 c.c. L. S. T.

Determination of residual chlorine [in water].—See B., 1942, III, 248.

Surgical sodium hypochlorite solution. Control and determination of alkalinity.—See B., 1942, III, 245.

Determination of iodine with the apparatus of Grote and Krekeler or Wurzschmitt and Zimmermann. H. Brintzinger and B. Hesse (*Z. anal. Chem.*, 1941, **123**, 13—15; cf. B., 1933, 290).—Details of the combustion, and data for org. and complex inorg. compounds, are given. The liberated I is absorbed in Br in AcOH + NaOAc, and thereby oxidised to IO_3'. Excess of Br is removed by means of HCO_2H, excess of KI added, and the titration completed by means of $Na_2S_2O_3$. When bases that retain I as iodide are present, anhyd. $Na_2S_2O_7$ and, if necessary, $K_2S_2O_8$ are added to the sample before combustion. L. S. T.

Rapid methods for determining iodine in soluble iodides and organic compounds. G. R. Clark and J. H. Jones (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 755—760).—Methods based on that of Groak (A., 1926, 1163) are described; for org. compounds fusion and dry ashing procedures are eliminated. Satisfactory results for various types of compound are tabulated. A. A. E.

Iodide determination by means of ferric chloride, and its application to the separation of chloride ion and to the determination of silver. W. Erber [with G. Lieber] (*Z. anal. Chem.*, 1941, **123**, 161—165).—The conditions under which the liberation of I from KI and $FeCl_3$ in presence of HCl is quant. have been worked out. The I' solution is mixed with suitable quantities of HCl and $FeCl_3$, heated at 60° for 8—9 min. in a well-closed I flask, cooled, and diluted. After adding NaF, the solution is titrated with $Na_2S_2O_3$ (CCl_4 end-point). For the determination of Ag, excess of KI is added to ppt. AgI, and then excess of I' is determined as above. The reaction between $FeCl_3$ and I' is applicable to most ratios of I' to Cl', and to limited ratios of I' to Br'. L. S. T.

[Determination of] fluorine [in foods].—See B., 1942, III, 244.

[Analysis of] sulphuric acid. H. W. Conroy (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 664—667).—For determination of ρ the Sprengel tube is preferred to the pyknometer. Tests for impurities are outlined. A. A. E.

[Stability of] standard sodium thiosulphate solutions. G. M. Johnson (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 659—661).—No preservative is necessary when 0·1N. solutions are carefully prepared. Procedure is described. Standardisation using I and using $K_2Cr_2O_7$ gave identical results. A. A. E.

Oxidimetric methods for the determination of thiosulphate, sulphite, and polythionate. R. Lang and H. Kurtenacker (*Z. anal. Chem.*, 1941, **123**, 169—187).—S_2O_3'' is run into an excess of acid or neutral Fe^{III} salt containing $CuCl_2$ or $CuSO_4$, and the resulting Fe'' titrated with $Ce(SO_4)_2$ (not $KMnO_4$), in presence of H_2SO_4. Ferroin is better than $NHPh_2$ or erioglaucine as indicator. The Fe''' oxidises S_2O_3'' quantitatively to S_4O_6''. SO_4'', S_2O_6'', and polythionates do not interfere. In presence of SO_3'', CH_2O must be added. S_2O_3'' cannot be determined by direct titration with $Ce(SO_4)_2$. S_2O_3'' can also be added to excess of H_3VO_4, acidified with H_2SO_4, boiled gently for 30 min., and the V^{IV} formed titrated with $KMnO_4$ to give accurate vals.; the S_2O_3'' is oxidised quantitatively to SO_4''. Polythionates and SO_3'' can be determined by similar methods for which details of procedure and typical data are given. L. S. T.

Rapid volumetric determination of sulphate ion. M. Randall and H. O. Stevenson (*Ind. Eng. Chem.* [*Anal*], 1942, **14**, 620—621).—Aq. $BaCl_2$ is added in excess to the solution containing SO_4'', and the excess is titrated with ~0·05M-Na_2HPO_4 (I) (Me-red) in presence of <27·5 vol.-% of EtOH. The time required is 10—15 min., and the accuracy 0·5%. NH_4^+ and heavy metals must be absent. Balachovski and Ginsburg's method (A., 1932, 34) using $Na_4P_2O_7$ instead of (I) is invalid. L. S. T.

[Standardisation of] thiocyanate solutions. E. C. Deal (*J. Assoc. Off. Agric. Chem.*, 1942, **25**, 661—664).—$AgNO_3$ is preferred to $HgSO_4$ as primary standard. Procedure for the purification of the materials and the titration is detailed. A. A. E.

Rapid determination of sulphur in pyrites and pyrite ash.—See B., 1942, I, 461.

Determination of sulphur in sulphite [wood] pulp.—See B., 1942, II, 400.

[Determination of] sulphur dioxide in wine.—See B., 1942, III, 239.

[Determination of] selenium [in foods].—See B., 1942, III, 243, 244.

Iodometric nitrite determination. E. Schulek and I. Floderer (*Z. anal. Chem.*, 1941, **123**, 198—209).—Apparatus, procedure, and typical data are described for the determination of NO_2' by means of the reaction $2HNO_2 + 2HI = 2H_2O + I_2 + 2NO$ in an atm. of CO_2. The methods are suitable for the determination of NO_2' in pharmaceutical products, and in presence of NO_3', NH_4^+, I', and Fe^{III} and Fe^{II}. They can be used on both macro- and micro-amounts. L. S. T.

[Determination of] nitrogen [in fertilisers].—See B., 1942, III, 228.

Determination of free and combined nitrogen acids in technical sulphuric acids, especially nitration waste acids.—See B., 1942, I, 460.

Decomposition and determination of sodium nitroprusside.—See A., 1942, III, 772.

Colorimetric method for [determination of] phosphates. Modification of A.O.A.C. molybdenum-blue method. L. S. Stoloff (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 636—637).—The modifications are an increase in vol. of sample and reagents, replacement of Na_2SO_3 by Na succinate, and colour measurements by means of a Coleman Universal spectrophotometer. The effective range is 0—0·35 mg. of P. There is a slow reduction of molybdate in acid solution, the rate of which is reduced to zero when the colour having a transmission max. at 460 mμ. is formed. L. S. T.

[Determination of] P_2O_5 in jams, jellies, and other fruit products. Preparation of stable acid molybdate solution.—See B., 1942, III, 243.

[Determination of] P_2O_5 in fruits and fruit products. Gravimetric and colorimetric methods.—See B., 1942, III, 243.

[Determination of] phosphoric acid [in fertilisers].—See B., 1942, III, 229.

Micro-determination of arsenic in biological materials. Electrolytic cell for production of arsine.—See A., 1942, III, 864.

Determination of arsenic in soils, foods, organic compounds, etc.—See B., 1942, III, 228.

[Determination of] arsenic [in foods etc.].—See B., 1942, III, 243.

[Determination of] boron. C. Krügel, C. Dreyspring, and R. Lotthammer (*Z. anal. Chem.*, 1941, **123**, 15—22).—Procedure [involving extraction with H_2O, distillation of the Me_3BO_3, and titration with NaOH (naphtholphthalein) in presence of mannitol] for the determination of H_2O-sol. B compounds in soils is detailed. For amounts of B_2O_3 <70 μg., the colorimetric determination using quinalizarin replaces titration. Data for sea-muds and "Klanxbüll" and "Dagebull" soils show high B_2O_3 contents (8—15 mg. per kg. of air-dried soil). L. S. T.

Determination of boric in presence of acetic acid. S. K. Hagen (*Z. anal. Chem.*, 1941, **123**, 187—197).—The procedure described avoids destroying the AcOH, or distilling the H_3BO_3 as Me_3BO_3. Total acidity is found by titration with aq. NaOH in presence of mannitol from a p_H val. of ~3 (2 : 4-dinitrophenol) to a phenolphthalein end-point. The H_3BO_3 content is determined by means of a similar titration from p_H 6·7 (bromothymol-blue) to the same end-point. The difference between the two titrations gives the approx. [AcOH]. The H_3BO_3 vals. have to be corr. by two empirical consts. With $AcOH : H_3BO_3$ <2, the error is <0·2%; for a ratio <10, it is <1%. NH_4^+, SiO_2,nH_2O, and org. acids must be absent. CO_2 must be eliminated throughout the titrations by means of N_2, and not by boiling. L. S. T.

Determination of boron in soils.—See B., 1942, III, 228.

Determination of boron and fluorine in soils.—See B., 1942, III, 228.

Silicic acid synthesis and its application in analytical chemistry. H. Fuchshuber (*Z. anal. Chem.*, 1941, **123**, 9—13).—A discussion of the mechanism of the formation of SiO_2,nH_2O from alloys containing Si when attacked by H_3PO_4 and H_2SO_4. Data showing that Jena glass is suitable for such determinations of SiO_2 are given. L. S. T.

Discrepancies in colorimetric determination of silicon in hiduminium RR series of aluminium alloys.—See B., 1942, I, 485.

Determination of silica and phosphoric acid in soil extracts.—See B., 1942, III, 228.

Low-tension sparks and spectrographic detection of difficultly excitable non-metals.—See B., 1942, I, 484.

[Determination of] metals in foods.—See B., 1942, III, 243.

Rapid determination of potassium with dipicrylamine. W. O. Williams (*Proc. Amer. Soc. Hort. Sci.*, 1941, **39**, 47—50).—Excess of Li dipicrylamine (saturated with the K salt) is added to the dry residue and the residual dye determined colorimetrically in an aliquot of the solution. The method is standardised by the use of KCl solution and gives results agreeing closely with those obtained by the K_2PtCl_6 method; it is specially useful when multiple sampling is necessary owing to variability of material. L. G. G. W.

Cobaltinitrite method for determination of potassium [in foods].—See B., 1942, III, 243.

[Determination of] potassium in fruits and fruit products.—See B., 1942, III, 243.

[Determination of] potash [in fertilisers].—See B., 1942, III, 229.

Volumetric determination of sodium chloride in bread.—See B., 1942, III, 240.

[Determination of] sodium and chlorides [in fruit and fruit products].—See B., 1942, III, 243.

Quantitative spectroscopy. S. Ashauer and G. Occhialini (*Anais Assoc. Quim. Brasil*, 1942, **1**, 32—36).—A method is described for the determination of small amounts of Ag in Pb by the length of lines in the arc spectrum, which are measured by interposing a lens, which can be adjusted by a micrometer, between the arc and the spectrograph. F. R. G.

Photo-electric determination of oxalic acid and calcium, and its application to micro- and ultramicro-analysis of serum.—See A., 1942, III, 788.

[Determination of] calcium and sulphur [in fertilisers].—See B., 1942, III, 229.

Microchemical detection of beryllium with ammonium molybdate. K. E. Stumpf (*Z. anal. Chem.*, 1941, **123**, 1—9).—Photomicrographs of the cryst. structure of ppts. obtained by adding powdered NH_4 molybdate to different concns. of $Be^{..}$ in HNO_3 are reproduced. The needles, attributed by Kramer (A., 1938, I, 97) to Be molybdate, are also formed when no $Be^{..}$ is present in the solution, and are due to a sparingly-sol. NH_4 polymolybdate. Kramer's test is invalid. L. S. T.

Determination of magnesium with 8-hydroxyquinoline. Micro-titration and photometric procedures. L. Gerber, R. I. Claassen, and C. S. Boruff (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 658—661).—5 μg. of Mg can be determined by pptn. as 8-hydroxyquinoline compound, oxidation of the 8-hydroxyquinoline (I) by heating for ≤15 min. at 95—100° with 0·05 N-NH_4 " hexaperchlorato-cerate " in 2M-$HClO_4$, and back titration of the excess of cerate with aq. $Na_2C_2O_4$ (indicator Setopaline C). One Mg requires an empirical val. of 59·7 equivs. of cerate compared with 8 in the bromination method. $Ce(SO_4)_2$ is much less effective in oxidising the (I). The photometric procedure described gives greater precision. The green colour obtained on adding $FeCl_3$ to the Mg 8-hydroxyquinoline compound in 1% AcOH is utilised. In the range 5—100 μg. of Mg, the colour conforms to Beer's law. L. S. T.

[Determination of] magnesium and manganese in fertilisers.—See B., 1942, III, 229.

Quantitative spectrographic analysis of zinc and aluminium alloys with the flaming arc.—See B., 1942, I, 485.

[Determination of] zinc [in foods].—See B., 1942, III, 243.

Spectrographic analysis of alloys of pure zinc.—See B., 1942, I, 480.

Spectrographic determination of trace metals in zinc and zinc compounds.—See B., 1942, I, 480.

5-Bromo-2-aminobenzoic acid as an analytical reagent. R. J. Shennan (*J.S.C.I.*, 1942, **61**, 164).—In view of its lower conversion factor, 5-bromoanthranilic acid is preferred to anthranilic acid for the determination of Cu, Co, Ni, and Zn. The solubility of the Br-compounds in aq. acetates and tartrates is suppressed by addition of excess of reagent. The determination of Co in absence of other heavy metals is facilitated by the direct weighing of the complex, which need not be converted into oxide or sulphate. A. A. E.

[Determination of] copper [in foods].—See B., 1942, III, 243.

[Determination of] copper and tin in beer.—See B., 1942, III, 238.

Determination of copper and zinc in soil.—See B., 1942, III, 228.

[Determination of] copper and zinc [in fertilisers].—See B., 1942, III, 229.

Rapid determination of copper, manganese, and magnesium in aluminium-copper-magnesium alloys.—See B., 1942, I, 485.

Photochemical analysis. [Volumetric determination of mercury.] G. Gopalarao and P. T. Ramacharlu (*Current Sci.*, 1942, **11**, 102).—$Na_2C_2O_4$ and $UO_2(NO_3)_2$ (as photosensitiser) are added to the solution containing $HgCl_2$, and the mixture is exposed to sunlight for 0·5—1 hr. to ppt. Hg_2Cl_2. Excess of standard I is added, and the residual I titrated with $Na_2S_2O_3$. Test data for determinations on 1—15 ml. of 0·05M-$HgCl_2$ show accuracy to ~0·5%. A. J. E. W.

Polarographic determination of cerium. G. Canneri and D. Cozzi (*Gazzetta*, 1941, **71**, 311—319).—Ce is determined polarographically at low concn. by the first reduction band of $Ce^{....}$ (at +0·355 v.) in 0·1N-H_2SO_4. The solution containing Ce (with or without other rare-earths) is treated with $Co(NH_3)_3(NO_3)_3$, and polarograms are obtained (*a*) before and (*b*) after addition of H_2O_2, which by the reaction $2Ce^{....} + H_2O_2 \rightarrow 2Ce^{...} + O_2 + 2H^{.}$ eliminates $Ce^{....}$; thus (*b*) corresponds with reduction of $Co^{...}$ and (*a*) − (*b*) with that of $Ce^{....}$. In order to avoid reduction of $Ce^{....}$ by Hg, the cathode is separated from the solution by a bridge of Na_2SO_4 in agar. E. W. W.

New thermoanalytical methods. II. D. Kaplan (*Chem. and Ind.*, 1942, 431—432).—The reaction $MnO_2 + 4HCl + CaBr_2 = MnCl_2 + Br_2 + CaCl_2 + 2H_2O$ develops sufficient heat (16° rise for 5 g. of MnO_2 in 100 ml.) for it to be used in determining MnO_2 thermoanalytically. ClO_3', BrO_3', OBr', and OCl' may be determined similarly with $CaBr_2$ and HCl. D. F. R.

Volumetric determination of iron by potassium dichromate. L. Barzaghi and P. Philipp (*Anais Assoc. Quim. Brasil*, 1942, **1**, 113—119).—Addition of H_3PO_4 in the determination of Fe by the procedure of Sarver and Kolthoff (A., 1931, 1141) has no effect for <0·8 g. Fe. F. R. G.

[Determination of] iron in beer.—See B., 1942, III, 238.

Determination of iron in soils and silicates by the mercurous nitrate method.—See B., 1942, III, 228.

Silicon, manganese, chromium, iron, [titanium,] and copper in a nickel-base alloy. Aliquot method for routine analysis of an electrical heat-resisting alloy.—See B., 1942, I, 482.

Rapid determination of tungsten, chromium, vanadium, and manganese in high-speed steel in splash sample.—See B., 1942, I, 479.

Determination of tin in foods.—See B., 1942, III, 243.

Complexes of titanium with aromatic hydroxy-compounds, and its photometric determination with chromotropic acid. A. von Endrédy and F. Brugger (*Z. anorg. Chem.*, 1942, **249**, 263—277).—Solutions of TiO_2 in conc. H_2SO_4 give intense colours with aromatic OH-compounds, and approx. absorption spectra are recorded for some of these. With chromotropic acid the complex has the composition $TiO_2 : C_{10}H_4(OH)_2(SO_3Na)_2 = 1 : 1$. Working details are given for the photometric determination of ≤0·0005% of TiO_2 with chromotropic acid. F. J. G.

Critical study of reagents for cations. VII. Thorium cations. P. Wenger and R. Duckert (*Helv. Chim. Acta*, 1942, **25**, 1110—1114).—A no. of reagents which have been suggested for the detection of Th^{IV} have been tested and the objections to their use are tabulated. The following are recommended: for micro-tests, $(NH_4)_2CO_3$–$TlNO_3$ (dilution limit 10^{-4}); for spot tests, 8-hydroxyquinoline (I) ($1·65 \times 10^{-5}$ on tile; 2×10^{-4} on filter-paper); for micro- and macro-tests, (I) (5×10^{-4}), H_2O_2–$Na_2S_2O_3$–$BaCl_2$ (8×10^{-6}), $PhAsO_3H_2$ (5×10^{-4}). Details of the characteristics and specificity of these reagents are given. J. W. S.

Oxidimetric determination of niobium. W. R. Schoeller (*Analyst*, 1942, **67**, 321—322).—Except in small amounts, Ta interferes with the determination of Nb by Treadwell and Nieriker's method (A., 1942, I, 307). S. B.

Analysis of indium alloys. C. W. Hopkins (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 638—639).—The methods of Moser *et al.* (A., 1930, 564) are satisfactory, and were used to prepare In solutions for the potentiometric titration method of Bray and Kirschman (A., 1928, 38). Analyses of In–Pb, In–Zn, and In–Al were accurate to 0·1 to 0·2%, but those of In–Sn could not be improved to give an accuracy better than 1%. Procedures and typical analyses are recorded. L. S. T.

XI.—APPARATUS ETC.

Determination of extinction angles in monoclinic pyroxenes and amphiboles. F. J. Turner (*Amer. J. Sci.*, 1942, **240**, 571—583).—The methods of Burri and of Nemoto for determining extinction angles in augites and hornblendes are discussed critically. Modifications of Nemoto's technique are described. L. S. T.

Self-registering micro-photometer for absorption and emission spectra. H. Mohler (*Helv. Chim. Acta*, 1942, **25**, 978—983).—The construction and operation of the instrument are described. J. W. S.

Quantitative spectrographic analysis by the arc method. M. N. Thruston (*J.S.C.I.*, 1942, **61**, 144—145).—A spectrographic technique, involving burning impregnated spills in an arc, which is suitable when large nos. of analyses for many elements are required but high accuracy is unnecessary, is described. It is simple and rapid and has been used to determine Na, K, Ca, Mg, Mn, P, and B in small amounts of plant materials with an accuracy of $\sim\pm5\%$. A. J. M.

Preparation of silver chloride films. P. Fugassi and D. S. McKinney (*Rev. Sci. Instr.*, 1942, **13**, 335—337).—Fused AgCl wets glass and adheres to it on solidification. It can be used as a glass cement, and owing to the fact that it can be rolled into thin transparent sheets, of which the transmission in the infra-red is >50%, it is useful as a window material for infra-red absorption cells. The prep. of such films is described. Their infra-red absorption has been investigated. They do. not darken appreciably in diffuse light. AgBr and AgI are not easily rolled, and the films crack easily. Films of Ag_2S have been prepared. A. J. M.

Portable indicating *X*-ray dosimeter. R. P. Krebs and H. Kersten (*Rev. Sci. Instr.*, 1942, **13**, 332—334).—An a.c. operated instantaneous-reading *X*-ray dosimeter, which can be used either after calibration against a standard, or for measuring, in arbitrary units, currents produced by ionising radiations, is described. It may be used with hard or soft radiation. A. J. M.

Phosphorescence microscope. E. N. Harvey and A. M. Chase (*Rev. Sci. Instr.*, 1942, **13**, 365—368).—Four methods of microscopical observation of the phosphorescence of cell structures or products, or microcrystals, are described. The illumination is short ultra-violet, and the specimen must be dry, or nearly so. A. J. M.

Simplified calibration of dropping mercury electrodes. J. J. Lingane (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 655).—The vol. of the Hg instead of its wt. is measured by means of the apparatus described; this reduces considerably the time required for the determination of the rate of flow of Hg from the electrode. L. S. T.

Platinum electrodes for electrolytic analysis. J. C. Chaston and H. W. Webb (*J.S.C.I.*, 1942, **61**, 145—147).—The design of Pt electrodes for routine electrolytic analysis is discussed. Economies in first cost are most readily secured by a drastic reduction in the size of the anodes. Very much smaller anodes than are customary are entirely satisfactory except when anodic deposits of Pb or Mn oxides are to be determined. The strength of the frameworks may be greatly increased by the use of hardened Pt, and attention should be given to some details of fabrication. Stationary and rotating electrodes recommended for use in stirred and unstirred solutions are illustrated.

Cæsium sulphide and cæsium selenide photocathodes.—See B., 1942, I, 444.

Multiple-electrode high-voltage arc for spectrographic analysis. W. D. Owsley and R. C. McReynolds (*Rev. Sci. Instr.*, 1942, **13**, 342—345).—An apparatus is described with a multiple electrode unit arranged so that 12 samples can be investigated without renewing the electrodes. The lower electrodes rotate at 400 r.p.m. during arcing. All adjustment controls are insulated and placed outside a safety cage. A. J. M.

Production of an atomic stream of known intensity. R. W. Ditchburn (*Rev. Sci. Instr.*, 1942, **13**, 349—350).—Possible errors in the use of the usual type of " atom gun " for producing at. beams of known intensity are described, all of which make the calc. v.p. too low, and film thickness too high. A form of apparatus which eliminates a no. of the errors is described. A. J. M.

Magnetic field measurement in β-ray spectroscopy. J. M. Cork and W. G. Wadey (*Rev. Sci. Instr.*, 1942, **13**, 369).—The magnetic field is determined by rotating a Ag disc in the field and measuring the e.m.f. produced. A. J. M.

Permanent magnet β-ray spectrograph. E. H. Plesset, G. P. Harnwell, and F. G. P. Seidl (*Rev. Sci. Instr.*, 1942, **13**, 351—361).—The construction of a large permanent magnet giving a highly homogeneous field of 3000 oersteds is described. The instrument is used in a β-ray spectrograph. A. J. M.

Simultaneous measurement of magnetic and dilatometric changes. O. Zmeskal and M. Cohen (*Rev. Sci. Instr.*, 1942, **13**, 346—348).—A combined magnet and dilatometer, for tracing simultaneously the magnetisation and dilatation of alloys undergoing phase transformations, is described. It may be used for rising, falling, or const. temp. The apparatus has been used for studying phase transformations occurring in the tempering of hardened steel, and some typical results are given. A. J. M.

Evaporation of standard solutions from the tips of micro-burettes. A. A. Benedetti-Pichler and S. Siggia (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 662—663).—With U-shaped burettes having remote control and with non-volatile active agents no error results when the simple precautions described are taken. Data for 0·5M-HCl and 0·1N-I are recorded and discussed. L. S. T.

Laboratory pressure flowmeter [for low gas rates under pressure]. L. J. Brady and B. B. Corson (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 656—657). L. S. T.

Pipette-type capillary viscometer for substances which are solid or highly viscous at room temperature. J. F. Weiler (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 634). L. S. T.

Oil manometer–manostat to control column throughput [distillation rate]. S. A. Hall and S. Palkin (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 652—654). L. S. T.

Design of still heads for batch fractionation in laboratory columns. Vapour take-off system. A. R. Richards (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 649—652). L. S. T.

Preparation of slides for particle-size determination. L. Silverman and W. Franklin (*J. Ind. Hyg.*, 1942, **24**, 51—52).—During spreading of a dust with a glass rod the particle size of cryst. materials is markedly reduced by pressure; dispersion by dilution and evaporation is therefore substituted. E. M. K.

Efficiencies for particle determination of the Electrotor, ultramicroscope, and Settlement Counter. S. C. Blacktin (*J.S.C.I.*, 1942, **61**, 161—162).—The particles, ranging from 0·4 μ. to 4 μ. diameter and 13,000 to 220,000 per ml., in dispersions of MgO and match-head smokes, are counted by the Electrotor Meter (*A*), the ultramicroscope, and the Settlement Counter. Comparison of results shows the instruments to have equal count efficiencies although each embodies a distinct fundamental principle, together exhaustive. The effective efficiency ranges of the three instruments are max. and reach $\sim10^7$ particles per c.c. The superior efficiency of *A* for lighter dispersions is explained as due to its innovation of a rotating record, and to its variable deposit area which includes one of <0·5 sq. mm.

Generator for air-free carbon dioxide or hydrogen. S. H. Tucker (*Analyst*, 1942, **67**, 320).—The generator previously described (A., 1939, I., 434) has been improved. S. B.

Frictional phenomena. VI. A. Gemant (*J. Appl. Physics*, 1942, **13**, 22—29; cf. A., 1942, I, 140).—A review of methods of viscosity measurements. L. J. J.

Treating bark corks. E. A. M. Bradford and A. W. Haynes (*Chem. and Ind.*, 1942, 369).—Bark corks coated with a thin film of Durofix adhesive can replace rubber bungs for use with certain solvents. Corks might be coated with other plastic or resinous materials known to be insol. in the particular solvent against which protection is required. R. G. W.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

History of Nernst's heat theorem. H. Ulich (*Angew. Chem.*, 1942, **55**, 211—215).

XIII.—GEOCHEMISTRY.

Manganese in the soil of the state of São Paulo. J. E. de Paiva Netto (*Anais Assoc. Quim. Brasil*, 1942, **1**, 42—54).—A review of the geochemistry of Mn. F. R. G

Isomorphous kinds of apatite.—See A., 1942, I, 404.

Is carbonate-apatite formed in aqueous systems?—See A., 1942, I, 404.

Relationship of the granites, aplites, microgranites, and rhyolites of the east of the Guéret massif, and the problem of their genesis. A. Demay (*Compt. rend.*, 1941, **213**, 455—457).—A discussion. L. S. T.